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Living Lab – Discovering the Essence

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Living Lab – Discovering the Essence

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Living Lab – Discovering the Essence

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Professori William Mitchelin sanotaan olevan Living Lab – teorian perustaja, joka kuvasi asumisen tutkimuslaboratoriota (Smart Cities) elävänä laboratoriona (Living Lab). Teorian perusidea on pysynyt hyvin samana vaikka tämä määritelmä ensimmäisenä julkaistiin 1900-luvun puolella. Loppukäyttäjien osallistuminen tasa-arvoisena osapuolena verkoston muihin jäseniin nähden (käyttäjälähtöisyys) ja innovaatioiden tärkeys korostuvat monissa Living Lab –projektissa. Living Lab – projekteissa omassa elinympäristössään toimivat loppukäyttäjät, yhteistyössä muiden verkoston jäsenien kanssa, tuottavat/kehittävät tuotteita/palveluja itselleen ja muille loppukäyttäjille.

Hankalinta oli sovittaa eri versiot samasta teoriasta yhteen. On turvallista sanoa teoriaosuuden ja haastatteluiden perusteella että Living Lab – määritelmiä on yhtä monta kuin asiantuntijoita. Syy tähän on muun muuassa Living Labbien liian monimuotoiset rakenteet joita on hankala verrata toisiinsa. Tämän takia tavoitteena tässä opinnäytetyössä oli selvittää vastaukset seuraaviin kysymyksiin: mitä on Living Lab, miten Living Lab toimii, mitkä ovat Living Labin haasteet, miten Living Labbejä voi kehittää, mikä on Living Lab - verkosto, miten verkosto toimii, mitä haasteita ja kehitysehdotuksia verkostolle on.

Teoria osuuteen kuului osio avoimesta innovaatiosta, mikä on mahdollistanut Living Lab toiminnan poistamalla yritysten sulkeutuneen lähestymistavan tuotekehitykseen. Ulkopuolinen apu on auttanut yrityksiä saamaan ideoita loppukäyttäjien tarpeista mitä ei sisäisissä tuotekehityksissä olisi ollut mahdollista löytää. Tuotekehityksen vaihtuminen käyttäjäkeskeisestä käyttäjäläheiseen osallisti käyttäjät yritysten tuotekehitysprosessiin. Innovaatio ympäristö on tärkeä osa Living Labbia, sillä se toimii ”tosi-elämän laboratoriona”testauksessa. Loppukäyttäjät jatkavat normaalia toimintaansa innovaatio ympäristössä ja altistavat kehitettävän tuotteen/palvelun arjen haasteille. Tärkeää Living Lab toiminnalle on teorian ja haastatteluiden mukaan jokaisen verkoston jäsenen osallistuminen.

Haastatteluiden ja teorian perusteella yksi keskeisimmistä tuloksista tutkielmassa oli että nykyinen Living Lab – versio on liian hajanainen verkoston jäsenien mielestä. Tulevaisuuden Living Labit tarvitset selkeän, mutta joustavan ohjeistuksen ja rakenteen. Myös nykyisten ja menneiden Living Lab – projektien yksityiskohtainen dokumentointi auttaisi benchmark esimerkkien hyödyntämisen tulevaisuuden projekteissa.

Ohjaaja Seppo Leminen

Asiasanat Living Lab, Living Lab-verkosto, avoin innovaatio, käyttäjälähtöisyys, innovaatioympäristö

Laurea University of Applied Sciences **Abstract**
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Degree in Business Management

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Living Lab – Discovering the Essence

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Professor William Mitchell is said to be the founder of the Living Lab theory. He described the research laboratory of living (Smart Cities) as a Living Laboratory (Living Lab). The basic principles of the theory have remained very similar even if the actual definition of the Living Lab was not published until the 20th century. The participation of end users as an equal partner with other network members (user-driven) and the importance of innovation are highlighted in several Living Lab projects. In Living Lab projects end users create and develop in co-operation with other network participants, products and/or services for themselves and other end users in a real-life environment.

The most challenging task was to unite the different theories into one whole theory. Based on the different theories and interviews there are as many definitions of Living Labs as there are specialists. One of the reasons for different definitions is the too diverse infrastructures of Living Labs which make the comparison of different projects challenging. This is why the purpose of this study is to discover answers to the following questions what Living Lab is, how it operates, what the challenges are there, how Living Labs can be developed, what a Living Lab network is, how the network operates and what challenges and development suggestions are there for the network.

The theory section also mentions open innovation, which has enabled companies to shift from strictly internal product development (i.e. closed innovation). External assistance has provided a quicker and direct access to the end user markets and helped the companies to discover the needs of the end user that could not be discovered in internal product development. The change from user-centric to user-driven product development made it possible for the actual end users to participate in the product development process. Innovation environment is an important factor of the Living Lab due to its role as "a real-life laboratory" in a testing process. End users continue their life in an innovation environment while exposing the product/service to the challenges of everyday life. According to the theories and interviews it is essential to the success of a Living Lab for each network member to participate throughout the process.

Based on the theories and interviews of the network members one of the main findings of this study is that the current version of a Living Lab is too scattered. Future Living Labs require clear but flexible guidelines and structure. Also the comprehensive documentation of present and past Living Lab projects would help the creating and benefitting of benchmark cases in the future.

Instructor Seppo Leminen

Keywords Living Lab, Living Lab network, open innovation, user-driven, innovation environment

Executive Summary

In the last five years Living Lab has become the new trend in the business world. The possibility of Living Lab projects reducing the number of products or services that fail to produce valid market value has of course attracted the attention of many companies and other operators. Despite the interest shown towards the theory and the results it promises it still fairly unknown and it's the current form is incapable of responding to the needs of the operators.

User-driven, real-life environment, network participants

Living Lab is a user-driven project conducted in a real-life situation where end-users, companies (utilizer), public sector (enabler) and universities or Universities of Applied Sciences (provider) create or develop a product or a service for end-users. The user-driven approach enables the participation of end-users to a project where they create and develop products or services for themselves and other end-users. The real-life environment challenges the product or service in its actual future environment thus unveiling issues that could not have been discovered in closed laboratory testing. A company releases its product or service for the project and in return receives fresh insight to the consumers' minds, free resources (methods, tools and labour for data gathering and analysing) from providers and the financial side is mostly taken care of by the enabler.

Multiple objectives, good foundation, common timetables and equal input importance

The Unlike in a traditional project, there is an array of possible objectives agreed upon in the beginning of a Living Lab project. This way the innovation factor of Living Labs can still be implemented without the limitations of just one possible outcome. The understanding of Living Lab as a theory and the purpose of a Living Lab project should be made clear to all the project participants since this would prevent the delays that have prolonged the starting of several projects in the past.

The timetable is an issue especially between the academia and business members of the network. The academia members see that the more a research takes the better the results will be when again in a business world the results need to be discovered quickly enough for the project to remain cost effective. In this sense it is vital to agree on a project timetable. Companies need to understand that a Living Lab project is a learning process that requires more time than just a few months but also on the other hand the project cannot continue indefinitely.

Although there are experts from various fields participating in the project, everyone needs to remember that the input importance is equal. This is to say that an expert should not look down on the opinion of a user or a student but think of every comment as valuable asset to the success of the project. This way the atmosphere inside the network remains open and receiving, enhancing the possibility of innovations.

The importance of communal co-operation and commitment to a single project and over projects, which creates cumulative experience and know-how

Living Lab project cannot be done by an individual, the innovations are born in a group of people from different fields of expertise who question and evaluate the processes of each other. An expertise of any field can be very set to his or her ways, but the input of other experts from different fields can alter the old process into a new, improved one. The commitment of all participants is essential for the project to move forward but the commitment over projects is essential for the development of Living Labs. If people would give their time for more than one project the experience and know-how about Living Labs would increase indefinitely. Also the conducting of future projects would become easier since people could learn from the mistakes and success of previous projects. Although an important factor, commitment is also a great challenge that current Living Lab projects face.

Company IP and confidentiality, and the quality of results

Living Lab requires openness from all the members of the network but for a company this is not possible. The revealing of company secrets and possible cutting edge technology is not possible and should not even be demanded, but it hinders the innovation process. Another factor that challenges the interest of a company is that the quality of a Living Lab project result is not necessarily beneficial for the company.

The lack of Living Labs common guidelines, methods and tools prevents the theory from reaching its full potential in current and future projects.

Despite the numerous experts in the field of Living Labs there is yet to be discovered common denominators that would combine all the different definitions together. The common guidelines, methods and tools would be important considering the future of Living Labs. Discovering common denominators would help in the conducting of future Living Labs, and also in the comparison and evaluation of past, present and future projects. This is the primary deficiency that should be solved in the near future. Perhaps the next project should be about the international guidelines, methods and tools for Living Labs.

Finding and motivating users

It would help the future Living Lab project is a way of finding willing users would be invented. As an example advertising in existing digital platforms like Facebook or Twitter about a digital platform for the project could be an effortless enough way for users to participate. After getting the attention of a user it would be necessary to hold that interest at least until the end of the project. Incentives are a way of motivating users but in long-term projects this might become quite expensive so instead an immaterial incentive for example a part of the credit could be sufficient.

Elaborate documentation

Until now the documentation of different Living Lab projects has been quite scattered and insufficient for the comparison of projects. For this reason there are not many benchmark cases that future projects can learn from. For future Living Labs to avoid the same mistakes and overlapping of the past projects, elaborate documentation of them is essential.

Defining when a Living Lab approach is beneficial

A Living Lab approach is not always the best. When the timetable is strict and the product a fast moving consumer good, it would be better to think of another approach. In the current stage of Living Labs, it is more suited for research purposes and service development where revealing the company secrets can be avoided. If this would be defined the number of completed projects would surely turn up.

As a conclusion the current form of Living Lab is not as business oriented as one would hope and for it to reach its full potential in the future it is necessary to take into account the mentioned factors and more. As such Living Labs will become projects that only attract public operators and that would destroy the meaning of Living Lab as we know it today.

CONTENTS

1 Introduction

1.1 Towards Living Labs

There are about 70-95% of private and public investments in R&D (Research and Development) of ICT (information and communication technology) based products and services that fail to produce valid market value. One of the major reasons behind this phenomenon is said to be that the initiation and execution of projects happen in a closed and/or artificial laboratory environment where the interaction is either too limited or comes too late. This deficiency prevents the proper understanding of the potential market and its users. (Living Labs Roadmap Work Group 2010, 3)

Industrial benchmarks have indicated that large open user communities create more qualified results over time than closed/restricted/artificial communities. When open user-driven innovation is developed and improved "to empower innovation in real world (not virtual) contexts and when based on PPPP (broad private-public-person partnership) (not single vendor) systems we call them Living Labs (Living Labs Roadmap Work Group 2010, 3)."

The founder of Living Labs is said to be Professor William Mitchell and the Media Lab and School of Architecture, MIT, in Boston. Professor Mitchell used the term "Living Lab" for the first time in the 20th century when he described a research laboratory for living. According to the professor, hidden needs can be discovered, prototypes built and the evaluation and enhancement of multidimensional solutions done with the help of user-centric research methods in a real-life living environment. In the beginning of this Living Laboratory operation thousands of hidden sensors measured the everyday behaviour of the inhabitants in the MIT campus area. (Rönkä, Orava, Niitamo & Mikkelä 2007, 19)

The Living Lab movement spread from the USA partly to Europe, and also to some third world countries in Asia such as China, Taiwan and South Korea. The Living Laboratory purpose expanded from only real-life living to work environments, district areas and city planning. As it spread outside USA, Living Lab took different shapes and discovered new domains where it could be applied. In Europe Living Lab became the new alternative to the already known testbed. (Rönkä, Orava, Niitamo & Mikkelä 2007, 19)

Defining the concept of Living Lab is not simple. There are different ways of explaining the concept and purpose of this theory, depending on the researcher. In his literature review Følstad offers three different categories:

1. a way of experiencing and experimenting with ubiquitous computing
2. a platform for open innovation
3. a way of exposing testbed applications to users

(Sthålbröst 2008, 31)

From these three categories, this study is focused on the connection between Living Lab and open innovation. Also numerous other definitions similar to these three are possible and plausible. In section 6 - Living Lab definitions, some of these categories are examined in order to create a basic structure of the Living Lab concept. One can already point out some characteristics of a Living Lab. There is the user-driven approach, the ecosystem which can also be called the network, the real-life environment where the lab is implemented and the objective of open innovation.

There are many different opinions and theories on what the Living Lab theory consists of but there is yet to be discovered a common basic structure for the theory. Many specialists have their own thoughts on how this theory works and how it can be beneficial in product development. The lack of common and unanimous structure has caused the theory to take different roles in its practical implementations and left the evaluation and comparison of results inadequate.

1.2 The primary objective

The primary objective of this thesis is to establish a common ground for the theory, which most of the specialists can relate to and agree on. To achieve this, two key questions need to be answered: What is Living Lab and what are the basic networks within the Living Lab?

The answer to both questions can be formed by understanding and explaining the following:

- The purpose behind Living Lab
- Important factors benefitting the success of Living Labs
- The challenges of Living Labs
- The development suggestions for Living Labs
- The networks operations and participants
- The network participants' main tasks
- The challenges of the network
- The development suggestions for the network

1.3 Current status

"Living Labs are collaborations of public-private-civic partnerships in which stakeholders co-create new products, services, businesses and technologies in real-life environments and virtual networks in multi-contextual spheres." (Schumacher & Niitamo 2008, 2)

It is possible to monitor the current status of Living Labs thanks to ENoLL (The European Network of Living Labs) founded in 2006 by the European Living Labs, the E.U., national and regional governments, academia and leading companies + SMEs (Small and Medium enterprises) in 2006 (ENoLL 2009). The operation is sponsored through numerous European projects and coordinating actions, for example COLLABS and CORELABS, from the European community. ENoLL's purpose is to encourage cooperation and exploit synergies between European projects and networks following the Living Lab methodology (Eurocities 2009, 2).

In 2009 there were 129 ongoing Living Labs in 29 different countries. Projects are not only limited to Europe but spread almost all over the world. In the attachment 1 all the participating countries are shown in alphabetical order and in attachment 2 the number of projects in each country. The countries not mentioned in attachment 2 (Croatia, Lithuania, Poland) have no ongoing Living Lab projects at the moment. (ENoLL 2009)

1.4 Limitations

In addition to Living Lab and test bed there are other development platforms such as Prototyping, Field Trials, Societal Pilots and Market Pilots which are mostly excluded from this thesis. All development platforms can be seen in figure 1 Testbed is explained briefly since it is very close to Living Labs and some of the theories even think that LL is only a different form of testbed. Other excluded topics are the different customer involvement methods which are briefly mentioned in section 7.3 - User participation in different phases of Living Lab, and quantitative research in section 9.

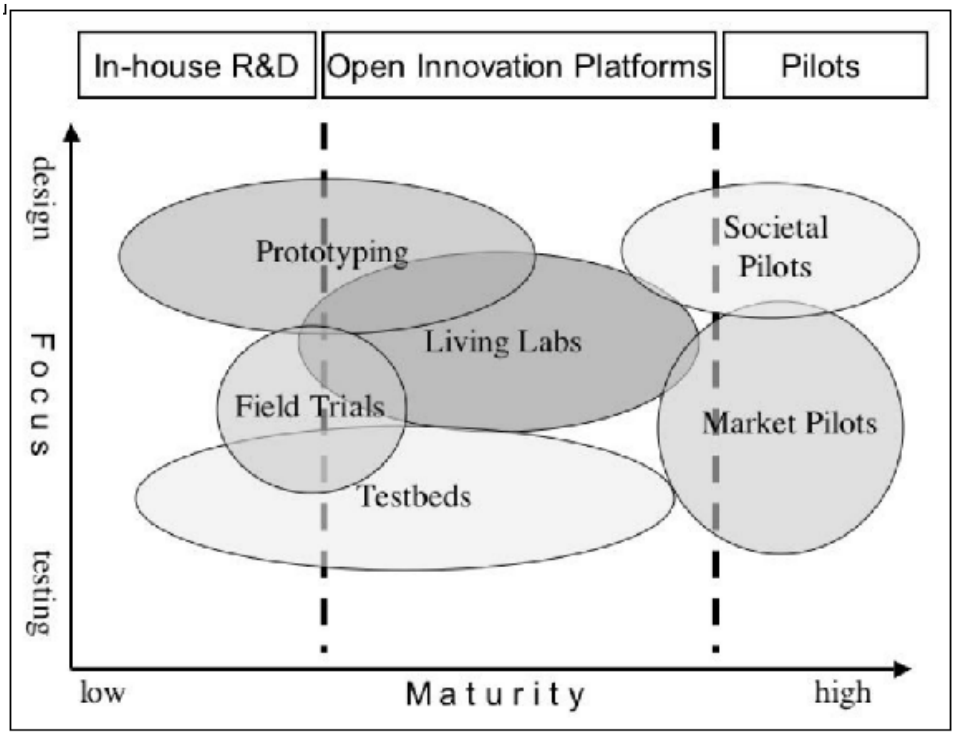

Figure 1 Development Platforms (Ballon, Pierson & Delaere 2005, 3)

1.5 Thesis structure

Section 1 is the introduction to the study and the subject of it. The first theory section (section 2) is about open innovation, where it all began. This only appropriate since the Living Lab owes its birth to open innovation. A theory launched by Henry Chesbrough suggests that due to the globalization, organizations can no longer rely on their inner R&D&I (Research, Development and Innovation). Organizations need to co-operate with each other by either buying or licensing innovations. In addition to this, the internal innovations which the organization cannot utilize should be available to external operators to offer benefits according to the same principles mentioned above. (Orava 2009, 11, 12)

The user-driven approach is explained in section 3 - User-centric vs. user-driven, which also describes the differences between them in more detail. In user-driven approach the users participate in the research, development and innovation process. The user is the subject of the process not the object. At its purest the motivation for the user is the passion towards the product/service in development. The user is an equal operator of the ecosystem which is the community network formed by all the participants in a Living Lab. This element of the Living Lab is described in section 8 - The Living Lab network. There can any number of participants in the network but according to the needs of each Living Lab, an ad hoc value network is formed that will dissolve when that specific Living Lab is over. (Orava 2009, 11, 12)

The environment for innovation emerges after the user involvement as one of the key ingredients that a project needs to be able to be called a Living Lab. In addition, it can be a physical, digital or a social environment that enables and encourages innovation. In the section 4 - Environment for innovation, the importance of the real-life environment for the Living Lab is explained. The real-life environment is the operational environment of the end users (inhabitant, employee, student, visitor, consumer or citizen) i.e. the living environment.

Close to a Living Lab theory and sometimes also confused with, is another development platform called a testbed. Here the environment is a structured and controlled area where products and services are tested. Section 6 drills down into the variations of the Living Lab – theory, each theory differing in emphasis and factors according to the specialists who is behind it. In the end of this section some similarities and mutual factors are drawn together to form a basic structure for a Living Lab.

The remaining sections of the theory, sections 7 and 8, describe the components vital to a Living Lab and also define the different network participants crucial to a Living Lab project. In section 9 the theory of empirical studies is explained briefly, only covering the theory of qualitative research that was used in this study. The answers from the interviews and their analysis are reported in section 10. Section 11 includes the conclusions of the study and the future aspects of Living Labs.

1.6 Chosen theory

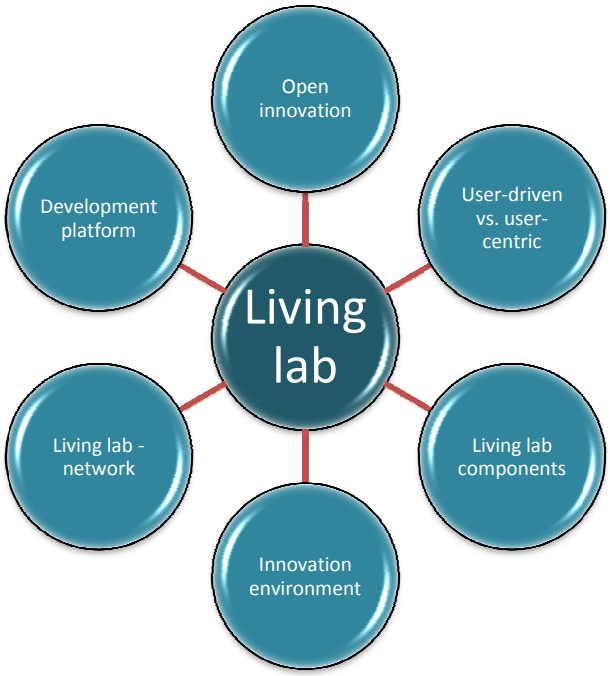

Figure 2 Theory components

All the theory components shown in figure 2 were chosen according to their relevance to the main topic - Living Lab. Open innovation is what originally prompted the development of the Living Lab concept. With the previous theory (closed innovation), before open innovation, the whole Living Lab concept would not have been possible. Examining the user-driven method shows how the end user is regarded inside a Living Lab. User-driven method also differs from the older method of user-centric where the user is the objective of product development and not the participant.

An environment of innovation is vital to a Living Lab. Without this, a Living Lab would be merely a modified test bed. The closest development platform to a Living Lab is a test bed which some people even see as the real theory of which Living Lab is only a different form.

The different definitions of a Living Lab are discussed to show the reader that one of the reasons Living Lab is still in its early stages is that the specialists have not come to any conclusions about the basic structure of a Living Lab. This section attempts to discover similarities between the different theory forms so that a combination of guidelines can be formed. These possible guidelines could help to decipher whether a project qualifies as a Living Lab project or not.

The key components are considered important, since they are points that need to be included in the Living Lab concept. These need to be established for it to be seen as a Living Lab project. The other fundamental principles are about the atmosphere during the project and between the participants. The user involvement in different phases of a Living Lab project defines the types of user participation.

The Living Lab network is also one of the important guidelines included in a Living Lab. Since the participation is seen as of great importance on which all the different specialists can agree.

2 Open innovation

2.1 Introduction to Open Innovation

"*Open innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well.*" (Chesbrough 2003, 43)

In open innovation, companies are looking for innovations and information from outside of the company. This is why the innovation process is made accessible to external sources and other stakeholders. Internal innovations which are not profitable to the company itself are sold or given to other companies that could have use for these innovations. (Kauppa- ja teollisuusministeriö 2007)

The use of internal knowledge makes sense only in surroundings where the external knowledge is scarce (which is unlikely in today's world). Open innovation places external information and innovations on the same level as internal information and innovations; and gives the companies the possibility to improve their market value and product development with these innovations that did not necessarily originated from inside the company. (Chesbrough 2003, 43)

Companies choose to use internal or external innovations according to what suits the business model best. The business model utilizes both external and internal innovations to create value, while defining internal mechanisms to claim some portion of that value (Chesbrough 2003, xxiv). With the help of business models the innovations that were not suitable for the existing models could be commercialized. Also intellectual property gained a new role with the emerging of the open model. Intellectual property could also be commercialized similarly to the tangible assets of the company; it could be sold, licensed or even given up to other companies. (Torkkeli 2008, 26)

To have a more concrete understanding of Open innovation Henry Chesbrough created different figures to support his theory. In Figure 3 the innovations come from inside or outside of the company and innovations that the company cannot use can be or sold to other companies to be used in different markets. It is important to notice that the innovations can come from outside during research or even as late as development phase or the innovation was internal but the technologies needed to benefit from the innovation are external.

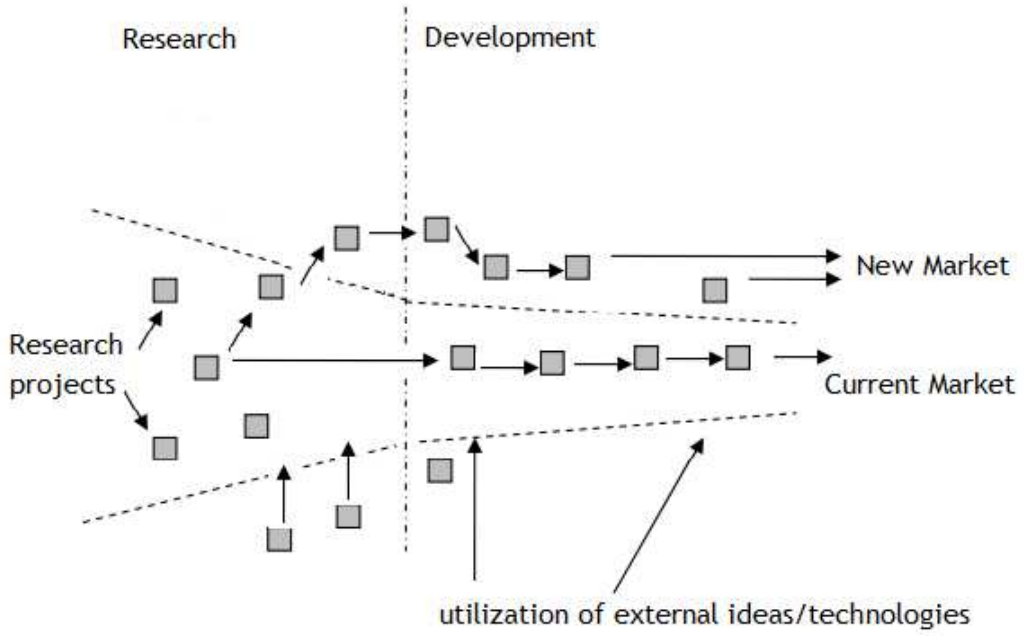

Figure 3 Open innovation (Chesbrough 2003, xxv)

2.2 The birth of open innovation

Open innovation is designed according to the changes in information distribution and flow. The emergence of the Internet caused the old model, Closed Innovation, to become outdated by providing easy and cost effective access to public and scientific databases, online journals, articles and other publications together with high transmission rates. (Chesbrough 2003, 44)

The Internet based material became available to almost anyone and the time consumed by research based on the information available decreased significantly. With free knowledge flow the importance of information decreased and also the differentiation of external and internal knowledge disappeared. With the disappearance of differentiation the companies gained access to a lot of new information that was hidden from them before. (Chesbrough 2003, 44) The external knowledge and expertise is abundant and the education for internal training is not needed hence allowing the company to concentrate on other issues.

With the help of the four written below, one can see that the distribution and diffusion of knowledge has overcome the Knowledge Monopolies that companies used to refer as their internal R&D departments.

The first indicator of the falling Knowledge Monopolies is the reduced consumption of R&D departments in big companies where the share of R&D has decreased approximately 40 %. Companies with less than a thousand employees have R&D departments that are still in use and in fact increasing.

The second indicator is the distribution of Patent awards. In 1999 of the 153,492 patents issued by the U.S Patent and Trademark Office (USPTO) the top twenty companies received only about 11.6 % (17,842) of all awarded patents. Small companies that used to own only about 5 % of the awarded patents in the 1970´s had succeeded in increasing the percentage up to 20 % by 1992. (Chesbrough 2003, 45, 46)

The third indicator is that the use of universities, professors and undergraduates has become one of the assets of the companies that adopted open innovation. As the government funding for university research declined, the universities sought support from industry. In this way the universities received the funding to their research and in return the industries gained early access to scientific knowledge. The more popular this custom became the more astute about the needs and problems of industry, the universities became. This new way of gaining knowledge meant that the company's internal R&D organization (closed innovation) became out-dated and too expensive compared to the low costs of funding a project where the information gained is not exclusive to only one company and therefore up-to-date and often brand-new. (Chesbrough 2003, 45, 50)

The fourth indicator is the increased number of graduates and post-graduates employed, which shows the social investment in human capital. Graduates also represent cheap labour since they are eager to learn and apply in practice what they have already learned alongside their professors. The pension system has also changed; before the pension followed the job and if the employee changed jobs he had to start collecting pension all over again, this guaranteed long-term employment and discouraged people to seek new jobs. Now the pension follows the worker which encourages the worker to change jobs and possibly even go abroad to work. With the movement of employees comes new innovations and information. (Chesbrough 2003, 48, 49)

2.3 The differences between open and closed innovation

The old product development model, Closed Innovation, was profitable for the companies and businesses of last century, but, now a days, the fast changing environment, where the knowledge and know-how are highlighted; the life cycle of products and technologies has been shortened; and the ever growing competition has forced the companies to establish new innovation models to improve their operations. (Torkkeli, Hilmola, Salmi, Viskari, Käki, Ahonen & Inkinen 2007, 26)

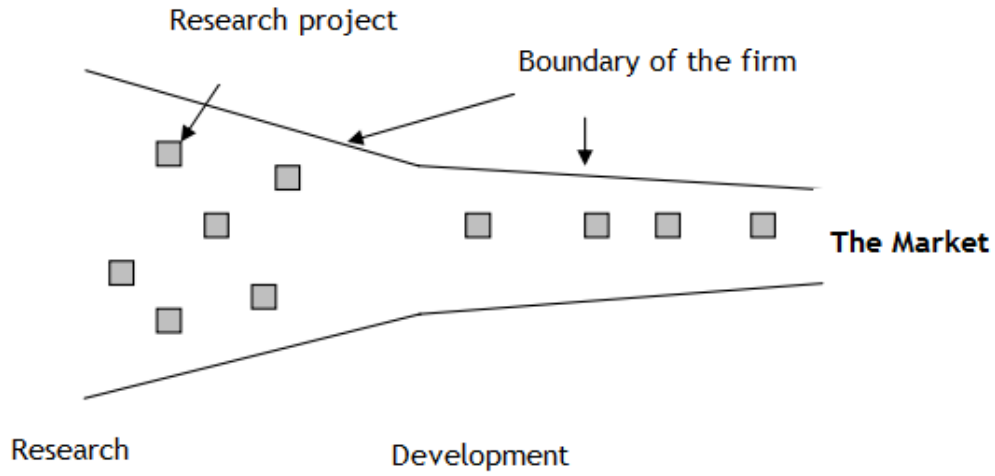

Figure 4 Closed Innovation (Chesbrough 2003, xxii)

In the old product model the company relied only on the innovations of the internal R&D department as it is shown in the figure 4. Companies did not trust the innovations of other companies and did not want to help other companies with their own innovations even though these innovations could not be commercialized through own market channels. This way of thinking worked when the companies were able to coax the best employees to work for them. Today this only works in fields such as nuclear and defence industry where the environment is not changing so fast. (Torkkeli, Hilmola, Salmi, Viskari, Käki, Ahonen & Inkinen 2007, 26) The differences between closed and open innovation can be seen if one compares figures 3 and 4.

Contrasting Principles of Closed and Open Innovation	
Closed Innovation	**Open Innovation**
The smart people in our field work for us.	Not all the smart people work for us. We need to work with smart people inside and outside our company.
To profit from R&D we must discover it, develop it, and ship it ourselves.	External R&D can create significant value; internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will launch it to market first.	We don't have to originate the research to profit from it.
The company that launches an innovation to market first will win.	Building a better business model is better than launching the innovation first.
If we create the most and the best innovations in the industry, we will win.	If we make the best use of internal and external innovations, we will win.
We should control our IP (Intellectual Property), so that our competitors don't profit from our innovations.	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model.

Table 1 Closed versus Open innovation (Chesbrough 2006, xxvi)

Table 1 lists the main differences between open and closed innovation. One of the main differences is that in open innovation the knowledge and people move between companies and sharing is considered vital instead of harmful. Also the pride of being the first in the market and doing everything alone is replaced with "let's do our best to be the best when we arrive to the market and accepting help is not a sign of weakness".

3 User-centric versus user-driven

3.1 Users in product development

The importance of users in innovation and product development has been recognized for decades, but only in recent years has the user involvement increased and gained momentum inside markets. The unique quality that makes users so important is that they directly benefit from innovations and products. The formerly more popular manufacturer-centric innovation process is still usable and recommendable in some fields, but user-centric innovation helps users to have exactly what they want without having to rely on media that might not understand their needs. (von Hippel 2005, 1, 2)

According to several studies the company's knowledge of its markets and users is one of the key elements to have when creating a competitive advantage. Users' needs are seen as the most important source for innovation; and over two thirds of companies include users in its innovation processes. Users can be involved at various stages of the process; they can be the origin of innovation, an aid in the estimation and development of innovations, and an essential asset in both testing of prototypes as well as the development of products and services. (Heiskanen, Hyvönen, Repo & Saastamoinen 2007, 17)

3.2 User-centric versus user-driven

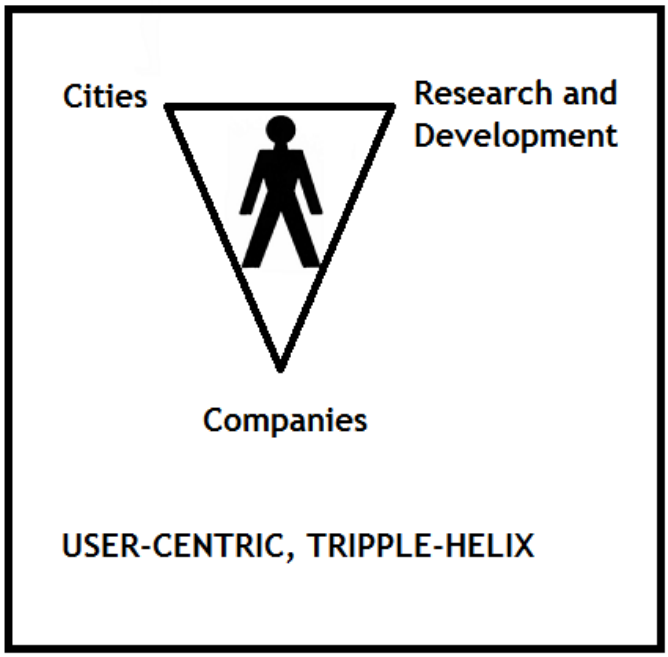

Figure 5 User-centric, Triple-Helix
(Jäppinen & Rönkä 2009, 3)

In a user-centric approach the user is the objective and the purpose of the innovations, planning and the result as shown in Figure 5. The users are only occasionally involved into the product and service development. (Jäppinen & Rönkä 2009, 3) Company's product/service developers are trying to work out what the users want, by using their own experience and possible research material. In this method the customer sees and tries out the product/service only after it is launched in to the market.

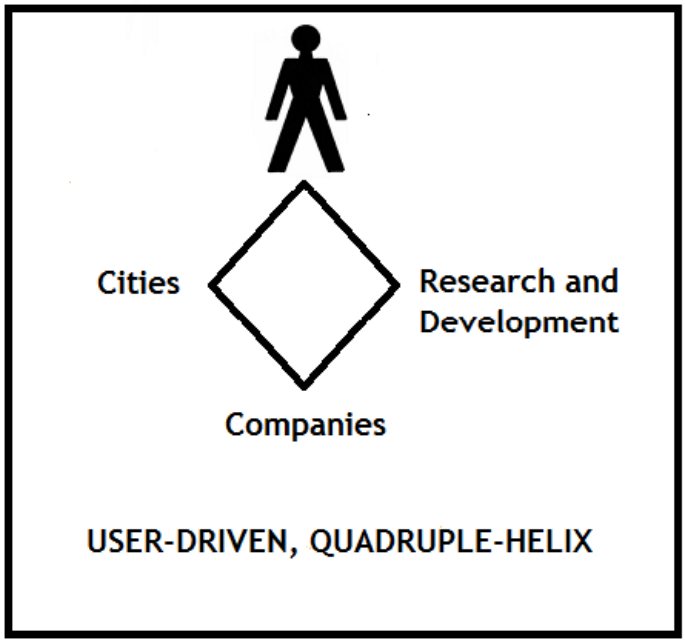

Figure 6 User-driven, Quadruple-Helix
(Jäppinen & Rönkä 2009, 3)

In a user-driven approach seen in Figure 6 the users are the ones with the innovations. Instead of being the objectives of planning; they actually do the planning (Jäppinen & Rönkä 2009, 3). In a user-driven product development the users participate in the planning, development and testing processes as a valuable information source. The users help to develop a product for themselves and they give feedback to the company representatives. In this method the user is an equal participant with the other members of the research, development and innovation operations. The motivator for the user is the passion towards the product/service under development and also the reputation and honour among other users. (Orava 2008, 2) Living Lab is a user-driven ecosystem (Helsinki Living Lab 2009).

3.2.1 Arts and Design City Helsinki Oy Case: Arabianranta

In agreement with the contract between Helsinki and other cities (1995) the Baltic Sea's leading Art and crafts Centre the Art and Design City Helsinki Oy (ADC) was founded in 1997 to execute the objectives and principles that were defined. The company carries out projects in co-operation with national and international communities. These projects are meant to increase the visibility of the Arabianranta-Kumpula area as the centre of creative industrialism and creative fields, and the know-how both in innovation and entrepreneurism related to these. The projects also support the effort of making the Arabianranta-Kumpula area an internationally attractive metropolis. (Arabianranta 2010)

Arabianranta-Kumpula has also developed as a Living Lab area where, in co-operation with the residents, companies, public parties and educational establishments, new products, services, business patterns as well as technologies are innovated – in a real-life environment with a user-driven approach. It is know-how is the execution of Living Labs related to living, usability and real-life ICT solutions. Arabianranta is one of the founders of ENoLL with 18 other Living Labs. (Arabianranta 2010)

3.3 Lead User

The old perception that manufacturers develop products and also modify them if users find something to complain about has been proven slightly defective by very strong empirical evidence. The evidence shows that both companies and individual users develop and modify products, which is important, widespread and more frequent than thought. The percentage of lead user (firm or individual) varies from 10 to 40 percent depending on the field. Studies have also shown that user innovations come largely from users with two defined user characteristics and the products developed by lead users more often than not create a basis for commercial products. (von Hippel 2005, 23, 20)

Lead users are defined as members of a user population with two specified characteristics that separate them from the other users; Lead users are ahead of average users in important market trends and are currently experiencing the issues that will later be experienced by the average user; lead users also foresee the benefits from discovering a solution to their needs, and hence, they innovate. The characteristics of a lead user, especially the first one, intrigues companies since it has been proven that products/services developed with the help of or by lead users often meets the needs of the average user (von Hippel 2005, 22, 23). The lead user (test user) is the user of the product/service currently being under development, for example as an occupant, citizen, employee, student, visitor, tourist or any other possible role. (Helsinki Living Lab 2009)

3.4 The early involvement of the user

In order to support the early phase of innovation, users should be involved with the product development process before the testing starts. This helps to decrease the innovation costs and increase income; the higher hit ratio and the decreased expenditure on bad innovations and better profits because of better innovations increase the overall profitability of the company.

4 Environment for innovation

4.1 Innovation environment

"Innovation environment is a physical, digital or a social environment that possesses the qualities that enable the generation of innovations" (Rönkä, Orava, Niitamo & Mikkelä 2007, 9)

An innovation environment is a constructed, operational and open environment that enables the generation of innovations and the sourcing of them. The purpose of an innovation environment is to enable innovators to create excellent tools/solutions. The main objective of an innovation environment is to serve the different parties involved in the environment so that the innovation process's lifespan is efficient and it progresses fluently. This type of an environment lures the operators of the same substance to operate together in order to create the best possible outcome. An environment possessing these qualities mentioned above is called a user-driven innovation environment. (Merenvainio 2009, 14)

An open environment for innovation enables the development both inside and outside the operational environment. In a situation where the innovation environment is concretely an environment in need of improvement, the openness enhances the surrounding area's status and creates new possibilities for areas which are not located in the centre of the concentration. (Merenvainio 2009, 14) When the environment acts mainly as the surroundings where the parties operate, the openness allowed among the parties enables the free flow of innovations.

Innovation environments are almost the direct result of understanding the purpose of user-driven development. These environments enable a new way for user-driven product development to operate. (Merenvainio 2009, 14) As mentioned in section 3; including users in the product development creates a competitive advantage for a company. The structure of an environment enables the users to be included into the process as early as the planning phase

of a product. Inside this innovation environment there is a place for all the participants and in the middle of it is the user as seen in the figure 7.

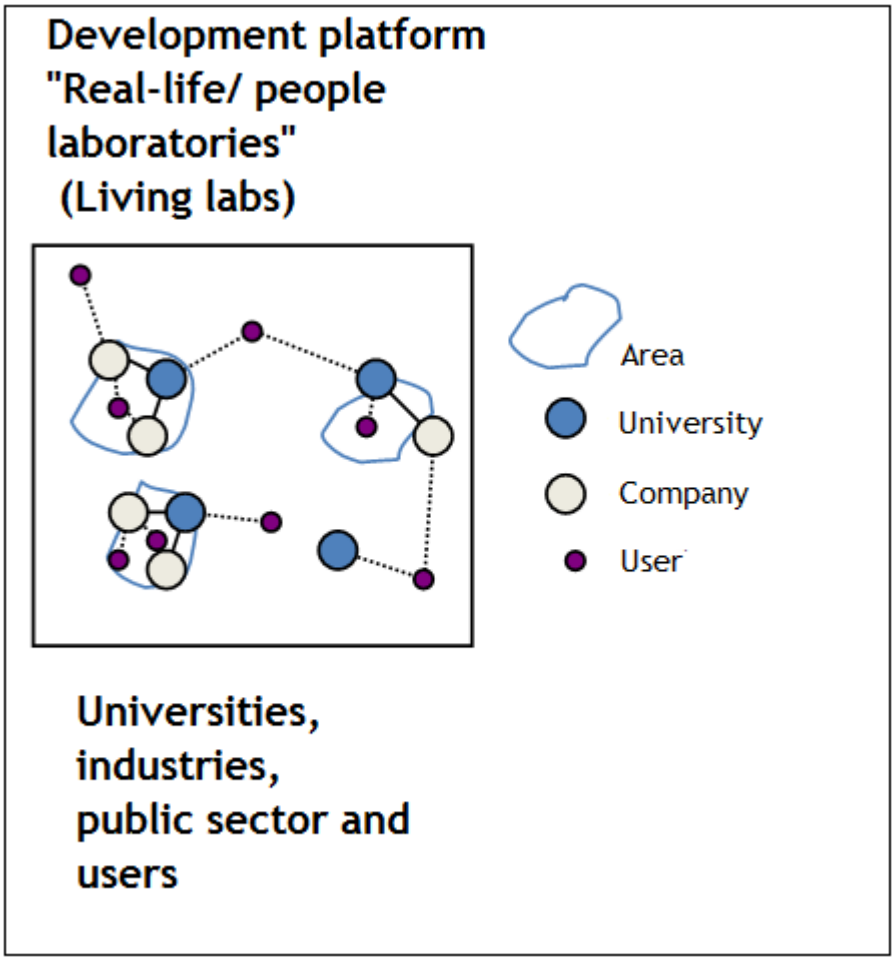

Figure 7 A user-driven civil society
(Jäppinen & Rönkä 2009, 4)

A situation where the innovation environment includes all the necessary parties is called a development platform which is shown in figure 8. A Living Lab innovation environment is the newest operational model of all the development platforms. The development platform method has created different product and service development models where the product or service in question can be innovated, tested and developed with the users before launching it to the markets. (Merenvainio 2009, 15) A short description of development platforms is given in section 5.

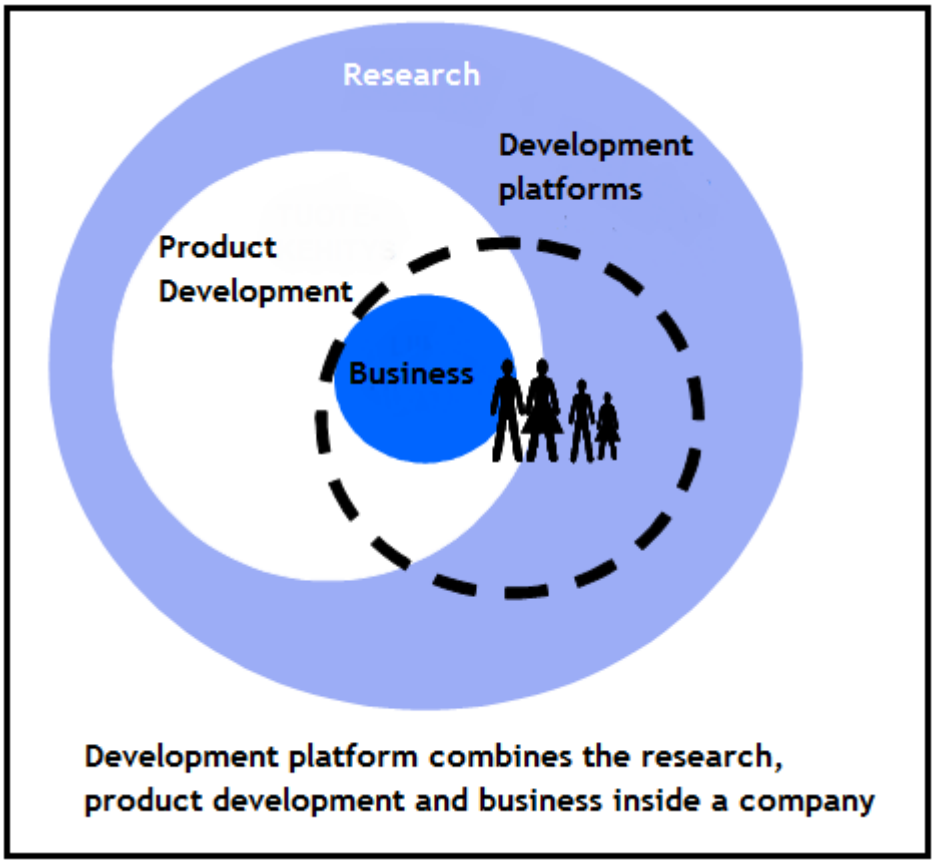

Figure 8 A development platform (Rönkä, Orava, Niitamo & Mikkelä 2007, 26)

4.2 Ba - An environment for knowledge creation

A similar concept to an innovation environment is a knowledge creation environment in Japan called *Ba*. In their book "Managing Flow", Nonaka, Toyama & Hirata (2007, 34) present *Ba* as a foundation for knowledge-creating activity. The importance of the physical or virtual space of interaction (*Ba*) has been identified and acknowledged by Nonaka and his associates.

"Knowledge depends on context because it is created in situated action" (Suchman, 1987). "Knowledge is also context specific in that it depends on a particular time and space" (Hayek, 1945). Summing up, "knowledge-creation is a process which is context specific in terms of time, space, and relationships with others" (Nonaka, Toyama & Hirata 2008. 34).

Ba, which translates to "place", "space" or "field", is "an existential place where participants share contexts and create new purposes through interactions" (Nonaka & Toyama 2003). In Japanese the word *Ba* does not only refer to the physical place, but a specific time and space or the character of relationships in a specific time and space therefore *Ba* should be understood as a multilevel interactive state that explains the interactions that occur at specific time-spaces - *Ba* can emerge in the following contexts:

- among individuals,
- in working groups,
- project teams,
- informal circles (a gathering of people in a pub),
- temporary meetings,
- in virtual space such as email groups and
- at the frontline in contact with the customer

(Nonaka, Toyama & Hirata 2008, 34)

In the example of an informal circle, people gather in a pub and talk in a friendly and open atmosphere about their "here-now" issues in a way that might trigger insight and resolutions about the issues. *Ba* is constantly moving and evolving according to the needs of others and the environment, changing their own context and the environment. This is how new knowledge is created, through change in purposes and context. The new knowledge, the future, is affected by the past (the context that the participants bring to the present) that in an emerging relationship shapes a shared context and perspective. Also the emerging relationship is in continuous change as the contexts of individuals in *Ba* change. (Nonaka, Toyama & Hirata 2008, 34, 35)

As a shared context, *Ba* means that the individual, subjective views are understood and shared in their relationship with others. Despite other researchers, Nonaka & al. (2008, 35) see that subjectivities need to be shared in interactions in order for knowledge creation to happen. The participation in *Ba* requires loosing oneself in order to be open to others; through the relationships in *Ba* one is able to embrace others' view points and values hence enabling the understanding and sharing of subjective viewpoints. *Ba* is the first place where knowledge emerges through shared perception and cognition of mutual existence. The boundaries of it are fluid and can change rapidly and the membership in it is not fixed. *Ba* is created, functions and disappears according to the needs of the participants.

The factors that are required for making *Ba* function are similar to the traits that enable the functioning of Living Lab in an innovation environment. *Ba* requires the following features:

- It must be self-organised and possess own intention, objective, direction and mission for example a company's knowledge vision can set direction and each *Ba* needs to establish actual work objectives and clarify intention, and middle management needs to be in the centre of this activity
- Participants must establish a shared sense of purpose; sharing of subjectivity, tacit knowledge and values help develop subjectivity

- Participants need to have various types of knowledge; new knowledge is created in the synthesis of subjective viewpoints, and enriched by the diversity of context and perspectives but this is only possible in a *Ba* that supports simultaneous and spontaneous interaction of the sections as a whole
- Boundaries are essential but need to be open; possibilities for expanding contexts are limitless hence, meaningful context-sharing must have boundaries, but openness is required for the possible connection with other *Ba*
- Participants need to commit to the objectives and willingly engage in its events and activities, even contributing their own personal time and energy to *Ba*

(Nonaka, Toyama & Hirata. 2008, 36)

Nonaka & al. (2008, 36) point out a few issues with the participant commitment. Some participants do not want to engage in *Ba* in the fear that sharing their own tacit knowledge with others might make them less valuable to the company. Another factor also weighing heavily as a challenge in Living Labs is the motivation that keeps the participants committed. The quality of the motivation is what separates the companies from each other. The endogenous motivation (i.e. personal aspiration and achievement) is better than exogenous motivation (money). Exogenous motivation can work in a short-term plan, but for long-term motivation inside a company the endogenous motivation is more reliable and might help experts to share their tacit knowledge to other participants in the *Ba*.

5 Development platforms: Testbed

5.1 Development platforms

Development platforms are either physical or digital development environments where products and services are researched, tested, developed or improved either in constructed conditions (testbed) or in real-life situations (Living Lab). (Rönkä, Orava, Niitamo & Mikkelä 2007, 4, 5, 9)

User-centric innovation environments, and development platforms, unite the producers and developers of products and services and the end users together. With the help of development platform concepts, different models for product and service development have emerged. These models enable companies to work in co-operation with users when innovating, testing and developing products/services before releasing them to the market. In this case the concept development platform contains two different development/innovation environments – testbed and Living Lab. (Rönkä, Orava, Niitamo & Mikkelä 2007, 7, 9)

5.2 Testbed

"An innovation environment constructed solely for the purpose of establishing the functionality of the technology currently under study, so called proof of concept -principle." (Rönkä, Orava, Niitamo & Mikkelä 2007, 9)

In a testbed, the technology of products and services is tested and developed in an environment that is built for this specific study. The risks that could occur in real-life situations can be avoided in these innovation environments where circumstances bear a resemblance to ones in laboratories. End users and other participants (the product and service suppliers and developers), who are a part of the development, play an assisting role in these situations. (Rönkä, Orava, Niitamo & Mikkelä 2007, 9) In the case studies of Ballon, Pierson & Delaere, (2005) they concur that testbeds and Living Labs are the most visible, and recognised test and experimentation platform concepts.

6 The definitions of Living Labs

6.1 Looking for similarities

"Living Lab is a user-driven, real-life situation harnessed for the usage of innovation. Here the attention is directed to the product's/service's end user who uses the innovation in question in an actual situation." (Rönkä, Orava, Niitamo & Mikkelä 2007, 9)

As mentioned in the introduction section, the definition of Living Labs depends on who is giving the answer. In this section some of the different ways of describing a Living Lab and the qualities that make Living Lab what it is, are presented. Different qualities are emphasised depending on the presenter, but in the course of this section it is hoped that the discovering some similarities and overlapping will help to form a basis to the definition of a Living Lab. At the end of the section all definitions are drawn together to establish the similarities that can form the basic structure for Living Labs. In the last section the potential of Living Labs is briefly assessed.

6.1.1 Environment and end user

In Living Lab research and development (R&D) methodology the innovations are created and validated collaboratively in multi-contextual, empirical real world environments (Schumacher & Niitamo 2008, 1). In other words, Living Lab project is made for a product or a service still in the development phase and is created in co-operation with end users and other participants of the value chain. The added value of the product or service is a result of the

place, situation and environment where it is tested. When the testing is carried out in a real situation the presumption is that the products/services are better than the ones tested in made-up situations. (Pitkänen 2006, 10) In addition to end users, the other stakeholders (suppliers and developers of products and services) support the end user's efforts to discover innovations and development suggestions for the use of products and services with their own operations. (Rönkä, Orava, Niitamo & Mikkelä 2007, 9)

6.1.2 Importance of the individual

Eriksson, Niitamo & Kulkki (2005, 5) emphasise the importance of each individual involved in the development whether it is in the role of a citizen, user, consumer or worker. They also add that by including all the participants of the value chain to the development process all the aspects of the ICT applications in a specific field can be analysed and experimented upon. In this way no specific technology or business model is favoured but the focus is on capturing the most suitable and useful technology there is. This shows that the implementation of Living Labs is actually a user-centric innovation system as opposed to the old technology centric system. The ability to interact with users is the distinctive and essential difference between Living Lab and the traditional supplier-customer partnerships.

6.1.3 Experimentation in the early stages of development

Ballon, Pierson & Delaere (2005, 3) defines Living Labs as an experimentation environment where technology is implemented in a real-life situation by end users who are considered "co-producers". In her doctoral thesis Sthålbröst (2008, 31) interprets Ballon et al. approach to have a strong emphasis on experimentation. According to Ballon et al. (2005, 8) a characteristic of Living Lab is to confront possible users with technology which is still in the middle of the innovation process. This view of the Living Lab is considered to have three advantages:

- helping in the development of context-specific views on development and acceptance processes, and in the interaction between them
- informing the researchers about possible conditions when the technology is embedded in the real-life experiment
- preparing the researchers for different scenarios where the embedding of the technology into a real-life situation could have on the societal impacts of innovation

6.1.4 A testbed for innovative solutions or a contextualized co-creation

The report on "Community Living Lab as a Collaborative Innovation Environment" by van der Walt, Buitendag, Zaaiman & Jansen van Vuuren (2009) for Corelabs provided a wide scale of different definitions but all still ranging between two main thoughts; Living Labs are either testbeds for innovative solutions or contextualized co-creations. In the table 2 below there are five different definitions from various writers and also a definition from CoreLabs.

Writers	Definition
Pallot, M. (2006)	Living Lab is an "innovation platform" which brings together and engages all stakeholders in the early stages of an innovation process to experiment breakthrough concepts and the potential value to all concerned and this leads to breakthrough innovations
ENoLL (2009)	Living Lab is a system and an environment for building a future where a real-life user-centric research innovation will be a normal co-creating technique for new products, services and societal infrastructures
Lama, N., & Origin, A. (2006)	Living Lab is a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real-life contexts
Lacasa, P., Martinez, R., Mendez, L., & Cortes, S. (2007)	Living Labs drive us to discover and try out new technologies in everyday life. People from different areas of life explore innovative tools, interact with them and discover new innovations to expand their knowledge and to explore ways of acting
Boronowsky, M., Herzog, O., Knackfub, B. & Lawo, M. (2006)	Living Lab is a constructed setting of technology, shared by various researchers sharing the same drive that is focused on discovering the results and helping each others to achieve their objectives.
CoreLabs (2009)	Living Lab is used as a way to examine community driven innovation in a real-life context. It is an opportunity to develop a deep understanding of how the various components in their functional environment operate and interrelate.

Table 2 Corelabs (van der Walt, Buitendag, Zaaiman & van Vuuren 2009)

6.1.5 A system enabling people

Yet another definition of Living Labs is "a system enabling people, users/consumers of services and product, to take active roles as contributors and co-creators in the research, development, and innovation process" (Living Labs Roadmap Work Group 2010 2010, 9). One

of the main roles a Living Lab has to have is the power to engage and empower users to participate in generation of valuable and sustainable assets towards objectives given by its partners and customers. According to this definition a Living Lab should be capable to:

- Form an appropriate organisation and partnership
- Motivate and empower large scale user engagement
- Establish adequate tools and infrastructure
- Form and execute case-dependent processes and manage IPR (Intellectual Property Rights)
- Disseminate a wide variety of results

(Living Labs Roadmap Work Group 2010 2010, 9)

6.2 The common denominators

Schumacher & Niitamo (2005, 1) and Rönkä & al. (2007, 9) all want to include the end users and other stakeholders early in the development phase and see the result as a combination of the place, the situation and the environment. Also, the researchers regard the importance of the end user to be greater than that all other stakeholders.

Eriksson et al (2005, 5) see the importance of the individual as the one essential factor when defining a Living Lab. However, they want to involve all the stakeholders equally to the project since the know-how of each individual in the different stages and areas of life can bring a variety of expertise to the development of a product/service.

Ballon et al (2005, 3) prefers to have the users involved in the development process as early as in the prototype phase. In this way the problems encountered in the prototype have already been removed or modified early on and the finished product should be one step closer to the final product launch.

van der Walt et al. (2009) report on “Community Living Lab as a Collaborative Innovation Environment” presents several definitions that can be divided into two mainstreams of thought; some of the definitions see Living Lab as a different form of a testbed, a pure testbed for innovative solutions. The other mainstream opinion considers Living Lab as a pure means to manage context research and co-creation with other users.

An additional definition is also from a report conducted by CoreLabs where a Living Lab is system based. Here the users/buyers take active roles as contributors and co-creators in striving towards an objective set by Living Lab’s partners and customers in a real world context. (Living Labs Roadmap Work Group 2010 2010, 9)

Despite the differences in the definition of Living Labs, there are some similarities that appear in each definition. Each definition requires user (firm or individual) involvement since one of the objectives of Living Lab is the opportunity to experiment and acquire user feedback. Also conducting the testing of a products/service in a real-life situation is one of the combining characteristics in most of the definitions. Some do not support the need for a real-life situation but still put the users in a certain situation where the testing is done. One more essential similarity among all the definitions is the purpose of Living Lab, innovations. User involvement is crucial in an innovation process. (Følstad 2008, 2)

6.2.1 A functioning and successful Living Lab in Finland

According to a study reported by Orava (2009) the factors that make Living Labs successful in Finland are the following:

- The ecosystem's operators committed to the Living Lab acknowledge their own roles
- The build-up of specialization and know-how of a certain field of business or life
- The fulfilling physical, virtual and social infrastructure that meets the requirements of the chosen specialization field
- Efficient and functional processes for implementing cases
- Existing users or at least an interface to potential users and knowing the users (demographic information and in time other information)
- Hired workers or people working on it in addition to their "real" job who understand the challenges and differences of Living Labs for example compared to traditional product development
- Acting as a component of a wider Living Lab –network in order to both exchange knowledge and know-how and expand the co-operation
- Cases whose implementation can teach systematically the different operators in the ecosystem both Living Lab process know-how and co-operation

(Orava 2009, 50, 51)

One can assume that at least a majority of these points would also act as success factors in a Living Lab done in a different country. This is why these points should be taken into account when building common guidelines for Living Lab projects.

6.3 Potential

At its purest Living Labs are implemented in a real-life situation with multiple customers/end users who provide the company or institution with new innovations, development suggestions and feedback that helps them launch and sustain product profitability in the market.

When mature enough, a Living Lab is able to provide services or instrument assets which add value both in industry (business relevance) and academy (research). For the companies/clients to gain sustainable success from a Living Lab, it needs to be able to establish a valid "business model" including feasible means to acquire necessary (financial) resources. (Living Lab Roadmap Work Group 2010, 7)

7 Components enriching the Living Lab concept

7.1 Required key elements

The required elements were presented among others by Sthålbröst (2008, 33). The key elements are participation and context, services, methodology and infrastructure. The participation refers to one of the main qualities of Living Lab already mentioned; the involvement of users and other stakeholders in the Living Lab process. The product and service development taking place in the user environment is the multi-contextual sphere to which the context refers.

The services that Living Labs provide to their customers (SMEs, industry, researchers or civic organizations) are:

- co-creation throughout the development process
- integration of the customer's products into the Living Lab
- data preparation that is summarized and standardized

(Ståhlbröst 2008, 33)

The methodology comprises choosing a suitable method based on a user perspective, which helps to involve users in the innovation process. The infrastructure element is the local infrastructure that can be used to support the process of interacting with users or it can also be the object being developed, tested and validated in the Living Lab. (Ståhlbröst 2008, 33)

7.2 Key principles

Continuity, Openness, Realism, Empowerment of users and Spontaneity (CORES) are key principles for Living Lab operations. Users and partners build trust and obtain unique knowledge over multiple projects, innovation cases and business experiments but this requires continuity. Openness is essential for gathering information, varying perspectives and allowing the full potential of user-driven innovation to succeed. It also helps to bring enough power to achieve rapid progress. The focus on innovation in real-life/work environment enables the realistic behaviour of users and stakeholders, which is required for valid results for real (realistic) markets. This realism is what differentiates Living Labs from other types of open environments for co-creation. (CoreLabs 2007-2010, 11, 12)

Users involved in Living Labs are not "guinea pigs" to be tested on but innovators, whose user power is enabled by empowerment and motivation, and engaged in an innovation process that helps to calculate the user needs and desires. This empowerment and motivation goes beyond just one project or case. The objective is to ensure continuity over time that creates users with wide experience from different projects, which helps them to become more effective as innovators. The success with new products and services forces one to inspire its use to meet personal desires, and both fit and contribute to social and societal needs. Detecting, aggregating and analyzing spontaneous user reactions and innovations along a product/service's full lifecycle requires methods and tools that support the enabling of continuous innovation. (CoreLabs 2007-2010, 12)

7.3 User participation in different phases of Living Lab

Living Lab has gained its ground among others with the intensive user participation throughout a product/service lifecycle and beyond, this is called the "users as innovators" approach. The different phases of user participation during a Living Lab project are shown below and under each phase there is a chart of methods used in the phase, and also the percentage of in which many projects this method has been implemented. (Schumacher & Feurstein 2007, 3)

1. Product/Service Idea

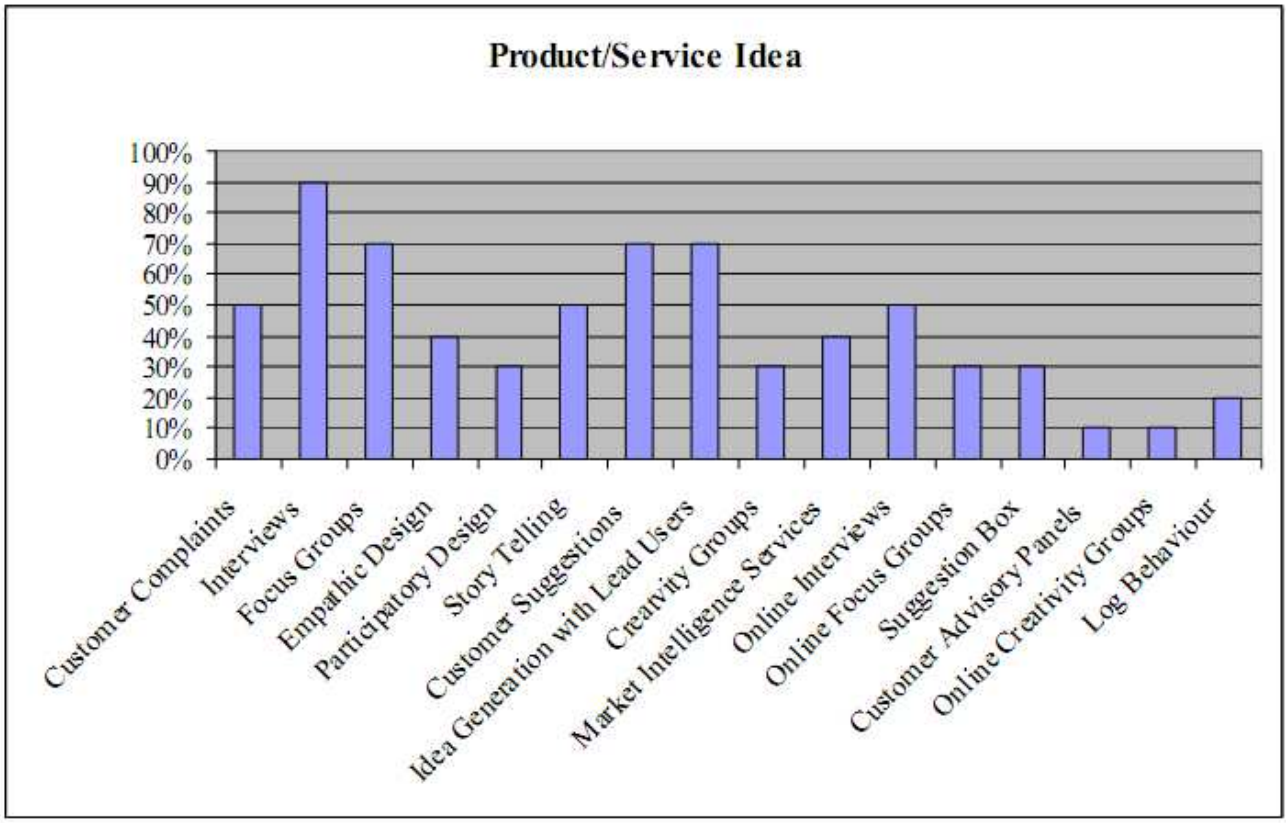

Chart 1 Methods used by the Living Labs within the Product Idea Generation Phase (Schumacher & Feurstein 2007, 3)

As seen in the chart 1; in over 50 % of the occasions interviews, focus groups, customer suggestions and idea generation with lead users are used as methods in Living Labs. About 50 % of cases the methods used in Living Labs are, customer complaints (viewing them and making adjustments to fix the issue), storytelling and online interviews. (Schumacher & Feurstein 2007, 3)

2. Product/Service Concept

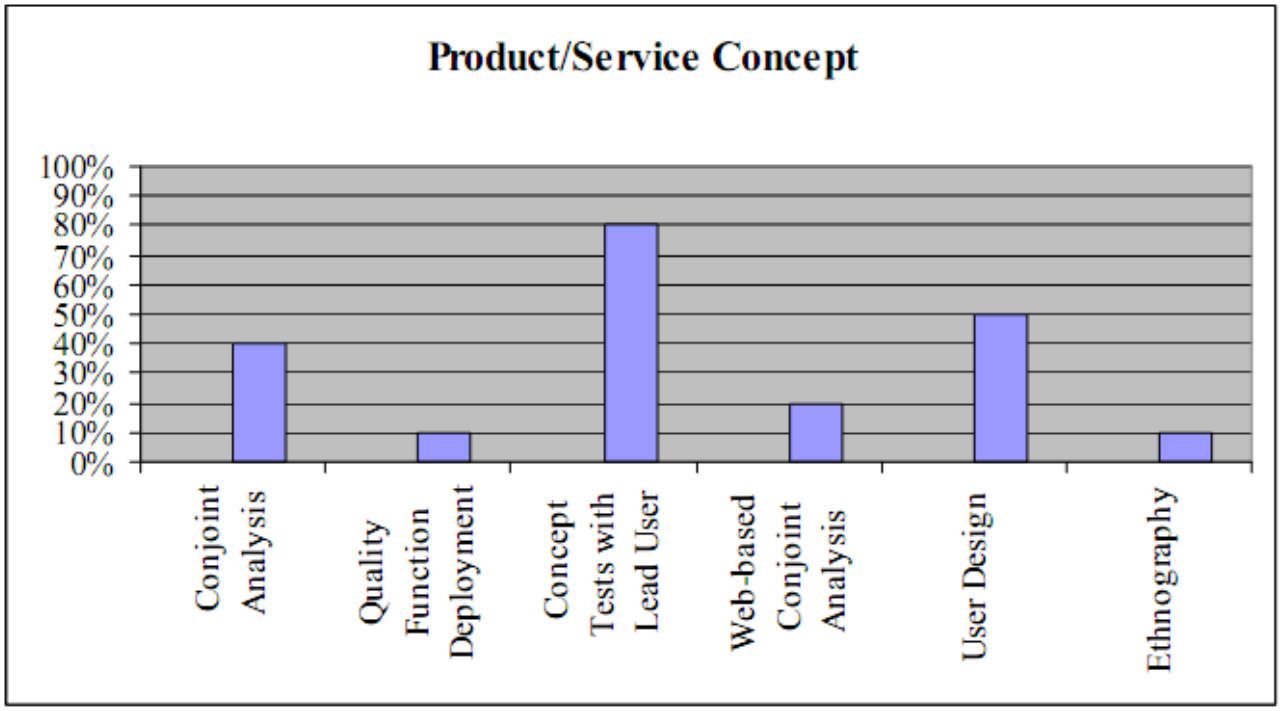

Chart 2 Methods used by the Living Labs within the Product Concept Phase (Schumacher & Feurstein 2007, 4)

In the phase of Product/Service concept the most common method is the concept test with lead users. It is used about 80 percent of the time as shown in chart 2. User design is a strong second method (Schumacher & Feurstein 2007, 4).

3. Product/Service Development

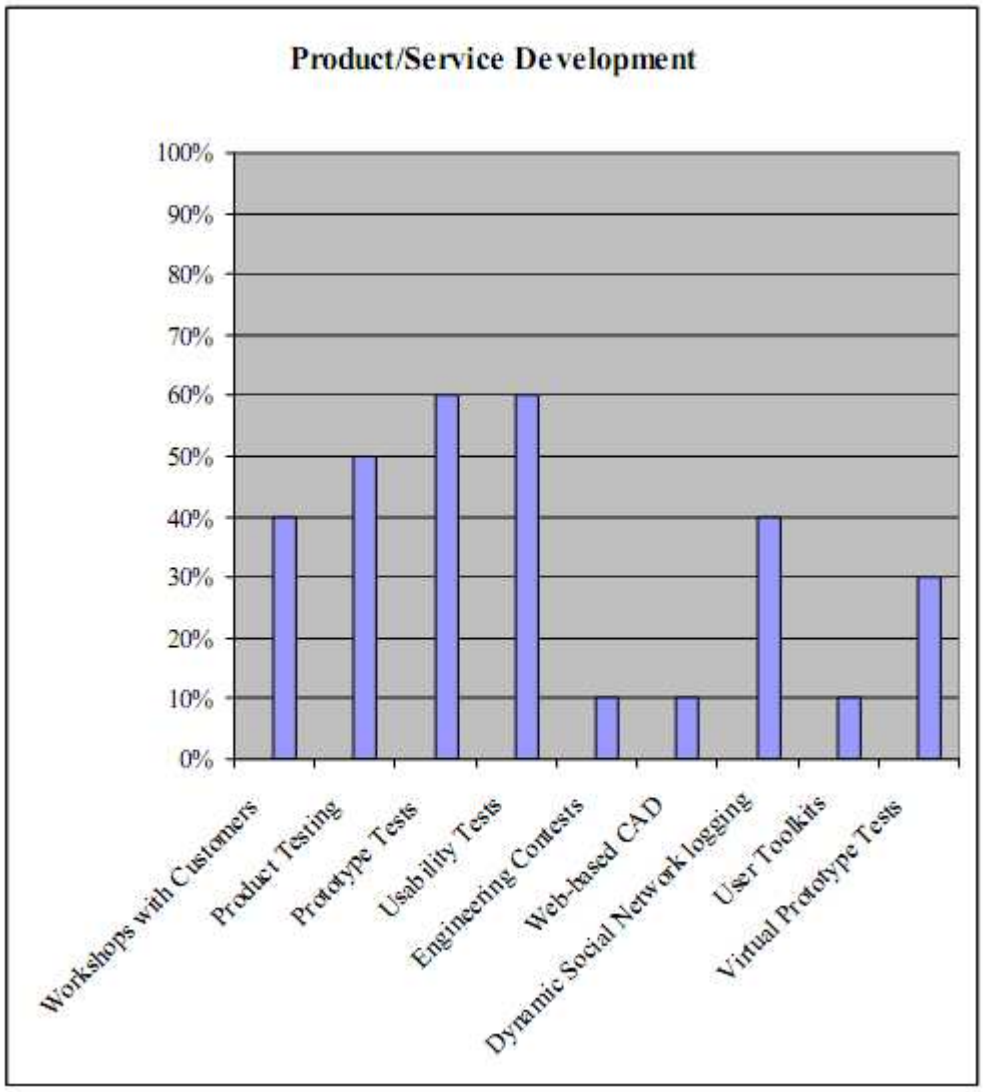

Chart 3 Methods used by Living Labs within the Product Development Phase (Schumacher & Feurstein 2007, 4)

In chart 3 it is shown that in product development, the most common methods are prototype testing and usability testing (60 %). Close second is product testing (50 %) (Schumacher & Feurstein 2007, 4).

4. Market Launch

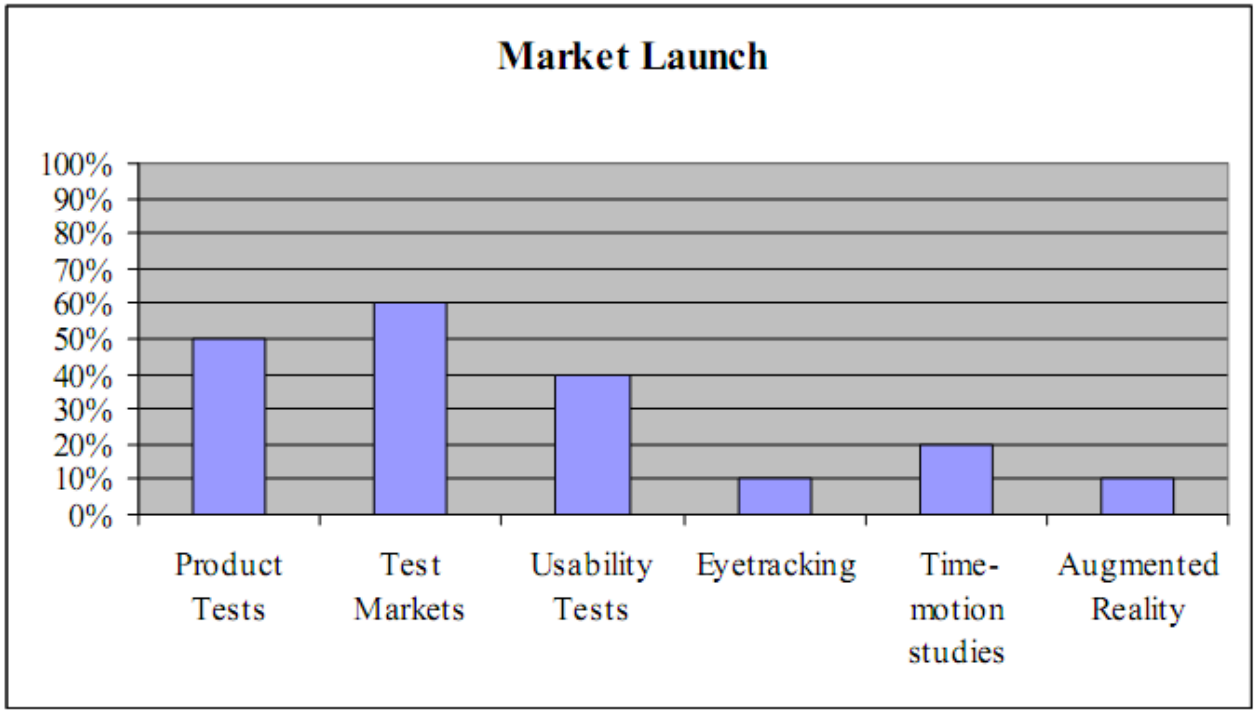

Chart 4 Methods used by the Living Labs within a Market Launch Phase (Schumacher & Feurstein 2007, 5)

During the market launch phase the most commonly used method is test markets and close second, product testing as seen in chart 4. (Schumacher & Feurstein 2007, 5) It is obvious that here and also in the previous phase (Product Development) the number of different methods is smaller than in the first two phases. It also seems that with the two latter phases the distribution of method use is smaller than in the first two.

7.4 Challenges

Despite all the good that comes from Living Labs, it faces some challenges. The founding of ENoLL has made it possible to avoid some of the overlapping of projects and trials but the lack of standardized instructions for the process, management, methods, tools and services is making it more difficult to produce proper benchmarking cases on which to compare and evaluate on the success or failure of projects. Also a standardised and documented Living Lab model and conceptual tools for all participants would help in the use and development of the current Living Lab. (Leminen & Westerlund 2008, 12)

The Living Lab project should be interlinked with the strategic processes of the utilizer; in order to understand their needs, motives and processes of the utilizer the nature of the Living

Lab –project should be long-term. It should also be possible for the utilizers to better see and understand the benefits and potential of the Living Lab innovation for current and future users and financial bodies. (Leminen & Westerlund 2008, 12)

Leminen and Westerlund (2008, 12) also see the need for a more formal procedure and objectives:

- briefing of the objective of the utilize
- an in-depth background of the case
- better role description of the participants
- use of advanced technologies

It is fundamental that the desired outcome of the Living Lab project should be outlined at the beginning of the project and since, the whole process depends on user innovation instead of one objective, and several possible objectives should be defined. Having only a single objective would restrict the true potential for innovation. The utilizer (company) of the Living Lab should be prepared for outcomes that might not be desirable or expected, since limiting the innovation tampers the main concept of innovation.

8 Living Lab network

8.1 Stakeholders

Living Lab projects engage all stakeholders related to the field in question. According to Ståhlbröst (2008, 37) a study conducted by CoreLabs in 2007 identified the relevant stakeholders. The common stakeholders are shown in the figure 9 below, “basic Living Lab concept”.

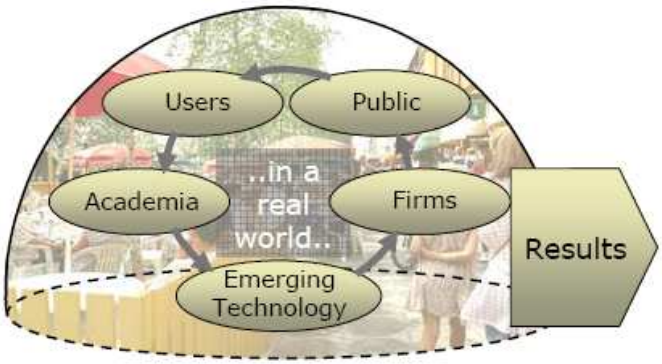

Figure 9 Basic “Living Labs” concept (Eriksson, Niitamo & Kulkki 2005, 5)

Academia includes academies and research organizations who are key stakeholders in deciding about the efficacy of collaborative approaches. The definition of users encompasses the civic sector and end users who are in an important position since they are the driving force for innovation in the validation environment. The public partners want to drive the development and innovation in the region in question to encourage enterprises and industry, and also allure specific resident groups. (Ståhlbröst 2008, 37)

SMEs are considered to gain most of the benefits that a Living Lab can offer in an environment of increased innovation and competitiveness but the public sector needs funding for the project. The other party can also be interested in the market trends and business practices that emerge from co-operation with Living Lab – business industry and service on a broader scale. The ICT (information communication technology) professionals are committed to the technical aspects and requisites and hence belong to the emerging technology section. (Ståhlbröst 2008, 37)

All the stakeholders have an interest in a Living Lab project. They benefit from participating or they profit from the result. Nevertheless, all of them are needed in order to be able to examine all of the angles of the innovation and gaining the best benefits from it.

8.2 Ecosystem and ad hoc network

Ecosystem is the community network formed by involved operators in the real-life environment. Some ecosystems can be very formal in style and others informal where people could join and resign without resistance. (Orava 2009, 28) One good example of an ecosystem is the Arabianranta-Kumpula area mentioned in the section 3.2.1. In this particular ecosystem the Arts and Design City Helsinki Oy will choose participants according the Living Lab in hand. On a general level this means that the ecosystem has many possible enablers, users, providers and utilizers. From these operators each Living Lab picks out the most suitable ones, an ad hoc network shown in figure 10, for a specific Living Lab (Orava 2009, 12).

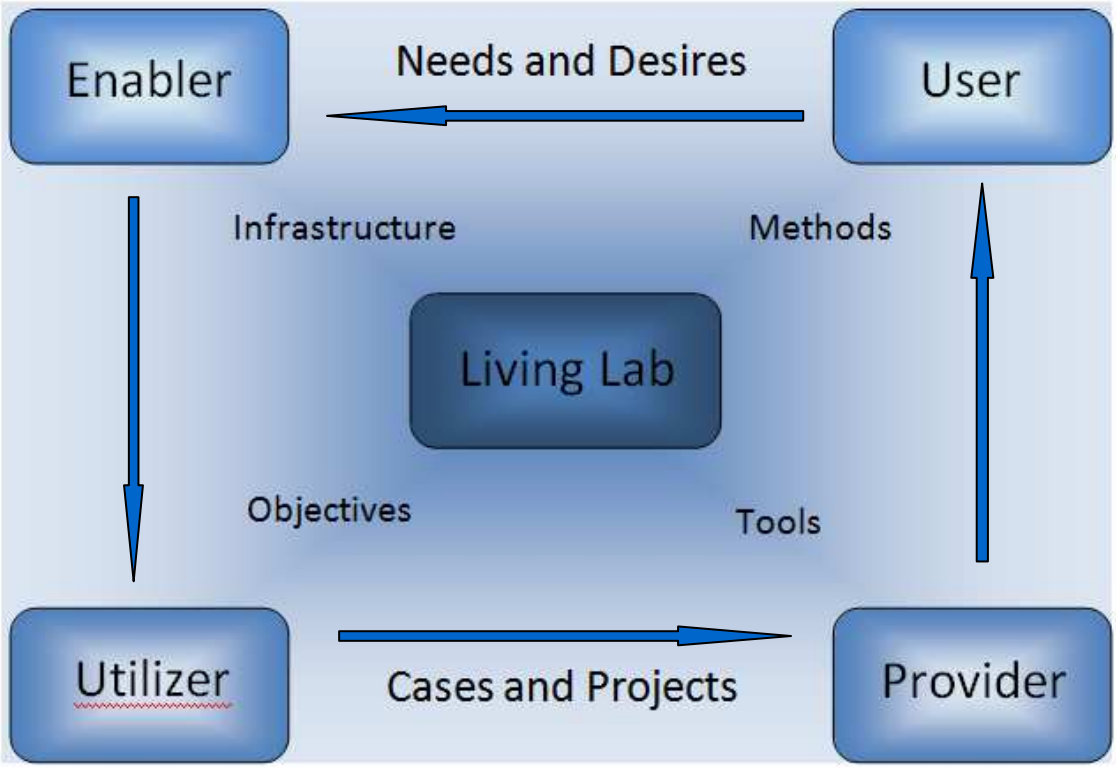

Figure 10 Living Lab Network participants

Enablers do not participate actively to Living Lab projects; they create the general infrastructure and policies and make it possible for other participants to operate. Enablers can be cities or other public sectors that among others finance the project operations. Providers offer their resources, tools and methods to the implementation of the Living Lab case. With these tools and methods the users' comments, feedback, improvement suggestions and other raw data can be collected. Afterwards the developers analyse the data and provide it to the utilizers in an agreed form. (Orava 2008, 3) Universities of Applied Sciences and other research and education institutes are usually seen as the providers in a network (Orava 2009, 28).

Utilizers want to use user-driven Living Lab –ecosystems to develop their products or services. They can be either companies or public operators. Depending on the interests and resources of the utilizers, they can just define the objective of the Living Lab case or even participate actively in the implementation of the case by providing the case with its end users. End users use the products/services under testing in their own real-life environment. They do not have a certain profile to fit in but they need to be open and prepared to give honest feedback about the product/service. (Orava 2008, 3)

8.3 The challenges of a Living Lab network and networked Living Labs

Despite the advantages of Living Lab networks and networked Living Labs, there are certain challenges in implementing and operating them. With a Living Lab network the issues are related mostly to the end users. Networked Living Labs the problem is in the integration that needs to be tackled on three individual layers. (Schumacher & Niitamo 2008, 9)

8.3.1 A Living Lab network

An individual Living Lab requires all the four participants of the network to operate properly. If one of the participants is missing it cannot be even called a Living Lab since the fulfilment of a Living Lab depends on all the participants operating in mutual consensus.

It almost goes without saying that the financing and infrastructure given by the enablers are vital for the project to start and keep on operating. The resources, tools and methods loaned by the provider help the project to operate on a level that can be accepted by the faculties (i.e. sufficient manpower, different databases and digital platforms for analyzing data and feedback and so on). The utilizer provides the product/service that will be developed and tested in a Living Lab. (Orava, 2008, 3)

Now the only one left is the end user. Since the lab is run in a real-life environment the difficulty lies in the possible effects the lab has on their everyday lives. It is important to put effort on the research of methodologies and supporting tools which enable the integration of a Living Lab to be as unobtrusive as possible. Another challenge is the engagement of users. As private people they do not have the need for the Living Lab to succeed except of course for the lead users. This is why methods and business models for the stimulation of individuals and possibly a related rewards and incentives mechanism should be considered. (Schumacher & Niitamo 2008, 10) This is the way in which the commitment of end users would be more definite than when we simply rely on the people's good nature.

8.3.2 Networked Living Labs

The heterogeneous infrastructures of different Living Labs make the co-operation between individual Living Labs challenging. The linking of these individual Living Labs is essential for future Living Labs and the success of this theory in practice. In addition to the infrastructure a clear structure of different methods and tools used in Living Labs is missing which is why the comparison of different labs cannot be properly executed. (Schumacher & Niitamo 2008, 9)

Creating a coherent toolset of best practices would help the comparison. Instead of letting individual Living Labs choose methods in random or according to the developments in the region, the stakeholders of these Living Labs should be trained to understand and use new methods and tools agreed by ENoLL, for example so that the future comparison can be made and benefitted from. (Schumacher & Niitamo 2008, 9)

The different policies and political views of regional and national Living Labs should be understood in order to create a successful endeavour. The main purpose is to integrate the political objectives so that we can ensure a global competitiveness of individual regions with diverse cultural and social backgrounds. (Schumacher & Niitamo 2008, 9)

9 Empirical studies

9.1 Qualitative research

It is generally considered that with a qualitative research, the purpose is discovering facts and not verifying an existing truth. The typical aspects of qualitative research are the following:

- Characteristic to the research is that the acquiring of knowledge is comprehensive and the material is gathered up in real-life
- A person is the preferred source of information
- Analysis is inductive (the researcher does not define what is important)
- The research material is procured using qualitative methods for example theme interview
- The target group is chosen purposefully and not by using a random sample
- The research plan changes along with the research (flexibility)
- Cases are examined as unique and the interpretation is done accordingly

(HIrsjärvi, Remes & Sajavaara 2006, 152,155)

During a qualitative research process the researchers need to be flexible and change their plans and objectives if the research requires it. People being a preferred research instrument, is due to the trust put into human observation and discussion. Another reason is the adaptability of humans in varying situations. The objective of qualitative research is to discover unexpected issues, which is why the starting point of a research is not to test a theory or a hypothesis. Popular methods in this line of research are the ones where the “voice” of a person is free to expose itself, for example an interview. (Hirsjärvi, Remes & Sajavaara 2006, 152,155)

These traits, which are recognized as characteristics of qualitative research, have proved that this study needed it as opposed to a quantitative one. Since Living Labs theory, although widely written about in different reports, has still no books / publications about it and even the theory has not been unanimously agreed on by the specialists, there would be little point in trying to test it out. As the theory is still in an early development phase it is seen more profitable to acquire the opinions of people who have had the opportunity to participate in a Living Lab project.

9.2 Interviews, the chosen qualitative research method

An interview is a unique method of research in a sense that the interaction happens linguistically and in real time. The advantage of an interview is considered to be the flexibility that is typical for this method. Also the possibility to interpret answers and define them with the interviewee is seen as a positive trait. Typical reasons for choosing an interview as a research method are:

- The interviewee creates definitions and is an active participant in the research
- The subject under research is fairly unfamiliar which makes it harder to foresee the answers
- The need to see the interviewee, the facial expressions and gestures. and the possibility to learn more about the interviewee
- It is probable that the answers/results of the research are miscellaneous.
- The received answers need to be clarified
- The need to go deeper (it is possible to ask more questions and ask the interviewee to clarify some points if necessary)
- The research subject is delicate or difficult

(Hirsjärvi, Remes & Sajavaara 2006, 194,195)

As already described at the end of section 9.1, the subject of this thesis is still fairly unexplored. It was predictable and even wished that the answers would vary in quality and the need to go deeper with the interviewees was necessary.

The interviews used in this thesis were similar to a theme interview where the subject of the research was already known and the interviewers had certain questions they used if needed (Hirsjärvi, Remes & Sajavaara 2006, 197). The order and structure of the interviews was free and went according to the interviewees answers.

9.2.1 Research material

The interviews were carried out originally for a course related to Living Labs. The interviewees were the same as the ones required for this thesis. The material of 11 interviews was freely given for this thesis as a source of information and analysis. The interviews were mostly about the links the interviewees had to Living Labs and user-driven open innovation (UDOI) but also about the definition of Living Lab and the issues that surround it were discussed. Since the interviews were not originally meant for this thesis, they are not included as attachments.

9.3 Collecting and analyzing the results

“After the interviews are conducted they are normally copy typed so that the analysis of the material is easier” (Hirsjärvi, Remes & Sajavaara 2006, 210). The analysis method is chosen according to what is the point of the research. If the purpose is to explain, then statistical analysis and drawing conclusions are the most often used methods. When the purpose is to understand, the qualitative analysis and drawing conclusions are good methods to use. (Hirsjärvi, Remes & Sajavaara 2006, 212)

9.4 Reliability and validity of the material

In all the studies, to capture the reliability and validity of the research is extremely necessary. The reliability refers to the repeatability of the study, how accurate the take is. Repeatability refers to the requirement that the same results should be achieved when the study is done for a second time. The validity of the study refers to the ability of a meter or a research method to measure the study. (Hirsjärvi, Remes & Sajavaara 2006, 216)

The reliability of a qualitative research can be enhanced by the clear reporting of the conducted study. The accuracy needs to reach all the aspects of the study. When gathering material the circumstances during the gathering of the material should be told clearly and truthfully, i.e. with interviews the circumstances, place, the used time, possible distractions, mistakes made in the interpretation and also the self-evaluation of the researcher should be described. (Hirsjärvi, Remes & Sajavaara 2006, 217)

10 Results and analysis

10.1 Interviews

The interviews (theme interviews), used in this thesis were conducted during a Living Lab related course in 2009. After this an intern was hired to literate the interviews. Nine relevant topics occurred repeatedly in the interviews. In the following sections the most common factors are combined for an overall picture of the current and future needs and challenges of Living Labs.

10.2 Living Lab

Living Lab is a user-driven project conducted in a real-life situation where end-users, companies, public sector and universities or Universities of Applied Sciences create or develop a product or a service for end-users.

As reported in section 6 of the definitions of Living Lab, everyone has their own definition of Living Lab. Some people/experts do not see Living Lab as a separate platform from a testbed but see it as an extension, a different form of testbed. In the interviews there were also as many answers as there were interviewees. There were some common denominators that outlined the main points of the definition:

- user-driven
- real-life environment
- needs all four different network participants

The user-driven approach means that the end user is not an object of a study but an active participant inside the network. (Interviewee 5) There is an interest in what the users want and what they have to say. The product testing happens in the users' own environment so they do not need to be in a laboratory but they can go on about their everyday life while participating in the project. The real-life environment also creates an advantage since the product/service can be tested in its upcoming environment and the everyday functions can be tested in a way a controlled environment would not allow. (Interviewee5; Interviewee 6; Interviewee 7; Interviewee 8) Utilizer (a company), provider (university of applied science), enabler (public sector) and user (end user) are all participants of a Living Lab –network, and are needed for the objective behind the project to succeed in a way it can be called Living Lab. It has real people, real environment, real customers and real customer needs; Living Lab is a people's laboratory (Interviewee 11).

10.3 Methods used in Living Labs

Digital platforms are the most cost effective and qualitative ways of gathering information from end-users.

According to Interviewee 1 the most cost effective methods from a company's point of view are interviews, observation and digital platforms. These digital platforms are meant for creating innovations and commenting on them, giving feedback and analysing the data that was put to the platform. The problem with this, as the general challenges of a Living Lab, is having the people to participate.

If a company sets up a digital platform just for single project, the participation of people requires quite a big effort and advertising. If, however, the company makes good use of the existing social media such as Facebook or Twitter where the people already are, it lowers the threshold of participation. Interviewee 2 suggested making an advert of the project/issue in already existing social media, this is the way in which the people who are interested could click on the advert and give their input freely. Here the problem of choosing the right people and having them to participate would almost completely disappear, providing that people would engage. Other possible methods are different variations of usability tests, expert evaluations and product/service testing (Interviewee 3).

10.4 Living Lab operations

When creating a new product or a service the most beneficial users are lead users that have an understanding of the product or a service, in the development phase a larger scale of users is more helpful.

Interviewee 2 said that the initial innovation comes from a company and the customers and other participants define the direction of it. The resources (labour, money, and product/service) for these projects are obtained from the network participants (Interviewee 8). A few of the interviewees said that the level of expertise differs in the various stages of a Living Lab. One possible scenario is that the lead users (see section 3.3) are used for the early stage of the project where the innovations are born. After this initial start up the innovation is taken to a bigger audience to see how it is received and how it works, feedback plays a significant role in this stage. After the improvements the products are ready for launching. (Interviewee 3; Interviewee 4; Interviewee 5)

Another way of looking at it was suggested by Interviewee 4. The way he sees it is that the closer the product/service comes to a conclusion, the more focused the user group needs to

be. Interviewee 6 thinks that the project is carried out as a team where each participant is responsible for a different area and afterwards they collect and analyze the data obtained from the project to form a unified result. The experience is seen through the customers' eyes and is taken apart with the help of the customer, the objective being the discovering of the purpose that makes the project to move forward.

10.5 Important factors for the success of LL

Several interviewees named traits that they considered essential for the Living Lab to operate properly. In order to be systematic, these traits were divided in to five different categories:

- Beginning,
- General,
- Network,
- Company
- User

Many other important comments were made but the ones are the most commonly mentioned or have a significant purpose when considering the written theory and material of the thesis.

For a Living Lab project to begin in the right manner multiple objectives need to be agreed upon and a profound foundation needs to be established and formed.

When starting a Living Lab project there are a few issues that need to be taken into account for it to operate properly. It is important to set multiple objectives. If the project is given only one objective, there is no room for innovation which, as seen in the general section below, is one of the main ingredients in a Living Lab. This is why an array of objectives gives participants more room to innovate. It is agreed that the objectives are to be set, at the beginning of a project and that there are several possible outcomes (must be one of the ones agreed) with the exception that something completely extraordinary is discovered without anticipating it. (Interviewee 1; Interviewee 6; Interviewee 9; Interviewee 10)

Another important point for the beginning of a project is that there needs to be a solid foundation. People need to understand what is expected from them and why. The purpose behind Living Lab has to be clear to all participants. (Interviewee 7; Interviewee 10; Interviewee 11)

Since the project is conducted in a real-life environment it is important to acknowledge the ethical rules concerning the privacy of end-users.

Real-life environment is the primary definition of a Living Lab. This is where the name Living Lab comes from. The product/service is given for users to test in an everyday situation. This reveals the type of problems that could not be reproduced in a controlled environment since anything from expected to unexpected can happen. The real-life environment does not have to be a physical place. (Interviewee 6; Interviewee 11) All the network participants should agree on ethical rules by which they abide during the project, for example the confidentiality of company secrets and how the everyday use of the product is observed. It is important to give the user space to do what they normally would do for if done otherwise the users do not want to participate and commit. (Interviewee 6)

Documentation is important for future Living Labs. In this way the same mistakes can be avoided and proven methods used all over again. Documentation also helps the project participants to figure out what went wrong is the project did not succeed. As the main financer public sector also demands elaborate documentation so that it can justify its decision to finance this particular project and possible gain future funding for similar projects. (Interviewee 4; Interviewee 9)

The quality of information varies in different stages of the project.

Knowing what information to use in each stage of the project is a key to success. Expert and lead user knowledge is needed at the outset of the project when the product/service is still not ready for the end users. When the product is ready for testing the knowledge of end users is important in defining what still needs to be done. In the development section of the project the technology know-how is important so that the product/service can still function properly after the improvements. (Interviewee 6; Interviewee; Interviewee 8; Interviewee 9; Interviewee 10)

The important qualities that help the Living Lab succeed and have the greatest effect are patience, passion, repetition and discussion (Interviewee 11). Patience is mostly required from the company as it normally wants rapid results, but also the patience between other participants of the network is important. It is necessary for all the participants to feel passion about what they do in the project, in this way the quality of the work is much higher than if people only do it half-heartedly. Repetition is necessary especially in the beginning if all the participants do not understand the concept of the project. Last is the constant discussion and interaction between participants that enables the feeling of teamwork and increases commitment. With the help of discussion all the different viewpoints can be understood and discovered. (Interviewee 2; Interviewee 4; Interviewee 6; Interviewee 7; Interviewee 11)

R&D&I (research, development and innovation) are the key qualities in a Living Lab. These qualities enable the customer participation. (Interviewee 6; Interviewee 8; Interviewee 9) The openness refers to the way participants receive the innovations of others. To have an open mind when discussing innovations creates a proper environment for innovation. (Interviewee 8; Interviewee 11)

As a general instruction for all Living Lab projects all the network members need to remember the importance of communal co-operation. Another important factor is commitment to a single project and over projects, which creates cumulative experience and know-how.

Interviewee 10 said that if marketing people work only with each other and designers work only with other designers then will not benefit from the communal co-operation that comes out of working with people from different fields. If a non-specialist asks a specialist why something is done the way it is, the specialist of this certain field needs to justify the way of doing in common terms, not using the jargon of this specific field. This can create new ways of approaching issues. Also if a specialist from a different field uses his/hers knowledge of their own field to apply on a different field this can also create new ways of thinking.

The commitment of all participants is very important for the success of the project. If some of the participants decide to quit in the middle of the project it cannot continue in the same way and loses some of the important qualities and know-how that make it Living Lab instead of a normal product development. (Interviewee1; Interviewee 2; Interviewee 4)

If people commit to Living Labs beyond the limits of just one project, participating in several projects then the created cumulative experience and know-how becomes very important for the foundation and development of the project. The systematic method refers to the fact that there need to be guidelines, instructions and objectives for the project. Without these traits the execution will not have a purpose and innovation will be aimless, and the point of a Living Lab is to create innovations on a given area/issue/topic. (Interviewee 1; Interviewee 2; Interviewee 4)

The network members need to agree on common timetables, objectives and understand the importance of each member.

A project cannot be called a Living Lab if it does not have all the network participant roles which are referred to in the section 8. All the participants have a certain predefined task before they start functioning inside the project. The enabler is the public sector which provides most of the funding for the project. The rest of the funding comes from the utilizer,

the company that in addition to money also provides the product/service under development and the experts. Collecting and analysing data is mostly the providers, Universities of Applied Sciences and universities, job. Giving information, comments, development suggestions and feedback to the utilizer and provider is the role of the users, end users. (Interviewee 1; Interviewee 6; Interviewee 7; Interviewee 8; Interviewee 10; Interviewee 11)

With a common timetable all the participants are aware of the progress of the project and will keep to it. According to many of the interviewees, especially for the research section of a Living Lab this is very important since researchers have a habit of doing matters on a very slow pace. The researchers need to understand the restrictions of a timetable as well as the company needs to understand that Living Labs are learning processes and will not suit to subjects with only a limited and very strict timeline. (Interviewee 1; Interviewee 4; Interviewee 10; Interviewee 11)

For the project to succeed and sustainable, it should have a purpose that speaks to all the participants; without this motivation and purpose the work will not create proper results. (Interviewee 1) The participants should understand that the each input is equally important. The experts should honour the comments of the end users and the company should be open to the suggestions of students (resources given by the provider) and end users. The atmosphere between participants needs to be open and trustful of each other; this will help the network to function as a unit, a team striving for the common good. (Interviewee 6; Interviewee 8)

A company gains a lot or free resources when participating in a Living Lab project but it also needs to relinquish a section of its power of decision to the hands of the user and learn to let go if necessary.

As discussed above, it is important for the company to learn to listen to the end users and their needs. No matter how much to company thinks a product will change the world, if the end users' feedback of the product is that it will not work, the company needs to listen and trust the evaluation of the user. (Interviewee 2; Interviewee 6)

The reason why Living Labs can appeal to companies is that they can use resources from the other participants of the network: most of the financing comes from the public sector, the help in conducting surveys additional labour in analysing data comes from the universities of applied sciences and universities, and the innovations, feedback, improvement suggestions and the confirmation for the product/service's suitability for the market comes from users. (Interviewee 1; Interviewee 5; Interviewee 6; Interviewee 7; Interviewee 8; Interviewee 11)

Another factor that can hinder companies from participating is the fact that there are no guarantees of a result that can bring business results. When a company joins a Living Lab network, it needs to acknowledge that it is looking for improvements for the future and sometimes it does not proceed in the direction the company was hoping for. If not stopped at a certain point a Living Lab project can consume a lot of funds without giving any proper results. This is why is important for the company to understand when a project is not worth continuing for. (Interviewee 3; Interviewee 4; Interviewee 5)

End-users need to be motivated into committing.

The users that participate in a Living Lab project need to be ready to commit to the project and even better would be if they would commit to Living Labs in general, so that they could act as end users in more than one project. This continuous commitment increases the cumulative knowledge, experience and know-how and creates lead users. To enhance the level of commitment the other network participants should think of an incentive to the user since they are not actually involved in the project as other operators. (Interviewee 1; Interviewee 2; Interviewee 4; Interviewee 10)

The companies gain valuable knowledge that could not be discovered in controlled testing, the public sector wants to be a part of a cutting edge theory and possibly gain some new theories out of it, and providers such as the polytechnic students gain valuable experience from a true work situation and also gain knowledge from company experts. The early involvement of a user helps to create a product suitable for markets already on an early stage of a project so some of the testing can be overlooked since already the end users are giving suggestions on how to improve the product/service. (Interviewee 1)

There are many factors that a Living Lab needs in order to be successful. To summarize all the important factors for a Living Lab are listed below:

- Beginning
    - an array of objectives
    - a good foundation
- General
    - financial situation
    - a real-life environment
    - ethic rules
    - documentation
    - the information needed in each stage of the project
    - patience, passion, repetition, discussion

    - research, development and innovation
    - openness
    - communal co-operation
    - commitment
    - cumulative experience and know-how
    - systematic operations
- Network
    - all participants accounted for
    - commitment
    - a common timetable
    - a purpose
    - the input quality is equally important
    - the atmosphere, ability to function
- Company
    - listen to the users
    - resources
    - results
    - know when to terminate the project
- End-user
    - motivation and incentives
    - early involvement of the user

10.6 User participation

A profitable form of user participation for Living Labs is the user involvement from an early stage to the very end of the project.

As a user-driven project format Living Labs rely on the participation and involvement of end users. The most common form of participation is by participating in interviews that companies and other network participants conduct. (Interviewee 1; Interviewee 3) Another fairly effortless way of participating in a project is answering to online brainstorming where end users are given very vague questions that leave room for innovation. The other network participants then try to interpret what are the customers' needs while analyzing the results. (Interviewee 2)

Other participation methods are more designed for Living Lab –projects. According to Interviewee 2 end users are encouraged to participate in the project from the beginning on since in this way it is possibly to gain the insight to what customers want in an early stage and

avoid unnecessary innovations. Also in the product testing stage the customer input is very important. Challenging the product in a real-life environment helps developers to discover problems that would possibly not occur in a controlled environment where the testing would be done by experts who already know how the product works. (Interviewee 3) Yet another way of participating is after the product testing when end users give feedback and improvement suggestions based on the use in a real-life situation (Interviewee 5).

10.7 The challenges of Living Labs

This question received many comments; some structuring of the main points was therefore necessary. The answers were divided to the following categories:

- Common
- Network
- Company
- Users.

The lack of Living Labs common guidelines, methods and tools prevents the theory from reaching its full potential in current and future projects.

The values and objectives should be set so that all the participants know what to work towards. Setting values and common objectives also helps the network to bond as a team and be motivated about the project (Interviewee 9). The timetable differences between researchers and companies were already outlined in the section 10.5. In short, the researchers wish to take their time and companies want quick results. (Interviewee 1; Interviewee 4; Interviewee 10; Interviewee 11)

There are Living Lab projects all over the world but for some reason there still are not enough benchmark cases which hinders future projects since people have very little to learn from. (Interviewee 1; Interviewee 5; Interviewee 9) One reason for the lack of benchmarks can be too heterogeneous Living Lab project infrastructures. If the infrastructures vary too much the comparison is very difficult. (Interviewee 5; Interviewee 8) These two issues were also cited by Leminen & Westerlund (2008) in section 7.4.

The lack of guidelines, methods and tools are the main reason that Living Lab has not gained significant momentum as a known and appreciated theory. Many of the interviewees said that since these three factors were missing, it was very difficult to start the project, to establish if what they were carrying out was indeed Living Lab and to involve some participants since they could not properly explain the purpose of the project. This was considered the main

problem by the interviewees and many of them said that without correcting it the future of Living Labs is very uncertain. (Interviewee 5; Interviewee 9; Interviewee 10; Interviewee 11)

Network members' continuous commitment enhances the increase of experience and know-how.

Also mentioned in the previous sections was the requirement of each participant in a project so that the project could function and be thought as a Living Lab. The communication inside the network is a challenge because of the array of people that work in it. The differences in profession, interests and motivation should be seen as assets that help the project but the participants need to be able to compromise for the purpose of communication to operate and aid the project. (Interviewee 1; Interviewee 8; Interviewee 10)

Participants may be willing to participate in one project but to sign up for possible future projects without any incentive is rare. The commitment to Living Lab and not just a certain project, would help the future projects since there would already be participants with knowledge of what to do. (Interviewee 1; Interviewee 7; Interviewee 8) The common good should be the main objective for all the participants but too often an individual prefers personal success over common (Interviewee 10).

A company cannot reveal its IP and secrets, especially when the results of the project are not necessarily profitable.

Without facts and results that benefit the company, it is very hard to acquire help with the finance and participation in the project. It does not help that many Living Labs do not actually create profitable results from the company's point of view. For the academia the information gathered from the project can be very important but a company needs something tangible to show for its investment. (Interviewee 1; Interviewee 7)

As many of the interviewees are employees of a company the company IP and confidentiality were a common topic of worry. They said that it is impossible to let people know everything, especially about product technology in the fear that it would not stay confidential. (Interviewee 4; Interviewee 7; Interviewee 9)

According to Interviewee 3, one of the problems between companies and end users is the fact that many of the end users would want to know if their innovation actually helped to company and would like to follow the project to the end. However, companies have a tendency to shut users out once they have obtained the needed innovation.

The project success can be very uncertain without a means of reinforcing user commitment.

A similar issue to the one with the company shutting out the user after it has obtained the innovation is the case of who receives the credit for the innovation. Some users participate voluntarily to a project without any need for motivation or incentive except that they would want credit/thanks for their innovation. Some of the users have also tried to sue the company for not giving them any credit for the innovation. (Interviewee 3)

It is important for the validity and reliability of the material to have a group of users that would be heterogeneous enough. If the group is too homogeneous then the answers and feedback can turn out to be very similar between users and this does not create a valid sample of the general opinion of the population. (Interviewee 2)

Many of the interviewees saw the commitment of users as one of the most challenging issues with Living Labs. Most of them suggested that a way of motivating users with incentives would be a good suggestion but how many users would participate to a project that could last even for three years for example for a few movie tickets? (Interviewee 1; Interviewee 2; Interviewee 5; Interviewee 7; Interviewee 8; Interviewee 9) It would be more profitable to find users that benefit from the Living Lab for example in the case of Arabianranta-Kumpula. There, also, the collecting of users does not cause issues, since the projects happen for, and in their living environment. (Interviewee 2; Interviewee 11) In other cases finding suitable users or even willing users without an incentive is very challenging.

Living Lab in its current form has many obstacles to overcome so that the operations can be profitable and create innovations. As a summary of this section some factors are listed below:

- Common
    - values and common objectives are unclear
    - timetable
    - lack of benchmark cases/ heterogeneous infrastructures
    - lack of guidelines, methods and tools
- Network
    - participants
    - communication
    - commitment over projects
    - common good vs. individual merits
- Company
    - financing/facts
    - non-profitable results

    - company secrets/confidentiality
    - after the company has gotten an innovation from an end user
- User
    - receiving credit
    - heterogeneous groups
    - user commitment (motivation and incentives)
    - finding users

10.8 Positive factors

When the interviewees named the good aspects about Living Lab many of them were good for a company, which does raise the question why companies do not participate in Living Labs more eagerly. This is why there are only two main areas that the answers were divided to: company and network

Having the users challenging the product or service in its real-life environment enhances the positive welcome in the market.

The additional labour/manpower (students conducting interviews and analyzing data) that companies are able to use if part of a Living Labs enables the wide scale research and interviews. Also the company can keep its paid employees attached to their own assignments and have students doing these tasks without monetary compensation. (Interviewee 1)

It has been discovered that products which are planned and developed in co-operation with end users are received better in the market than the products done only by the company. The products created with the assistance of end users fail in the market less often. Since the end users notice the possible issues the product would have when entering a market less after sales is needed. (Interviewee 1; Interviewee 4; Interviewee 5; Interviewee 6; Interviewee 9)

The know-how that a company receives when co-operating with the rest of the network improves and changes the ways of thinking inside the company. The benefit of challenging the product in a real-life environment helps to uncover problems that would have not been produced in a controlled testing environment. With this concept the companies are able to also see into the homes of the user and see for example if the product in testing is something that needs other appliances to work and how many people actually own the needed equipment for the product to function properly. (Interviewee 4; Interviewee 6; Interviewee 8; Interviewee 9; Interviewee 10)

Communal expertise is born in a discussion with experts from various fields.

The networks benefit from the communal expertise that is born when all the network participants communicate and discuss openly about the issues that arise during the project. Such know-how will only be born when people from different fields, areas and with varying interests gather together to create something new that cannot be learned from books. (Interviewee 4; Interviewee 6; Interviewee 8)

According to the interviewees the following factors make Living Lab a good theory that can be implemented in product development:

- Company
    - additional labour
    - from end users to the end users
    - increase possibilities for the market/less after sales
    - increased know-how
    - discovering unknown issues/concentration towards technical issues is reduced
- Network
    - communal expertise
    - creates know-how that cannot be learned from books

10.9 The future of Living Labs – Living Lab 2.0

Living Lab would need a version 2.0.

When asked about the future of Living Labs many of the interviewees agreed that the current state of it cannot continue without dying out at some point in the next years. Interviewee 10 said it so that is summed up all the answers: we would need a Living Lab 2.0 version. This new version should have guidelines, given methods and tools and a proper structure so that the projects do not falter in the beginning due to the lack of help, benchmarks and instructions. He also suggested a commercial operator that would collect and organize projects according to their commercial value. This would decrease the academic angle that is currently so strongly present.

Interviewee 2 and Interviewee 5 see that Living Lab will continue to operate but in a smaller scale or in a narrower field than it does now. They both acknowledge the importance of testing with end users but according to Interviewee 2 Living Lab will mostly be used for service production. Interviewee 9 thinks that in the future the innovations should come from end users and not companies; otherwise the theory might fade away.

10.10 The development suggestions for Living Labs

For the Living Lab concept to continue improving and establishing its place as a permanent way of developing products/services, it needs to be developed from its current form. Only one of the interviewees did not give any development suggestions, the other ten had several suggestions how to help Living Lab to the next stage.

The guidelines, methods, tools, structure and values need to be established for the benefit of future Living Lab projects.

Mentioned several times during this study is the need for guidelines, methods, tools and structure. Guidelines would define the criteria that a project needs to fulfil in order to be called a Living Lab. These would also help people understand Living Labs and start the project more swiftly, since the participants already know the purpose behind the theory. (Interviewee 5; Interviewee 6; Interviewee 8; Interviewee 9; Interviewee 10)

A list of methods and tools was also seen as a having value. (Interviewee 1; Interviewee 8) These lists might speed up the starting stages and also make it easier to implement projects seeing that the methods and tools do not always need to be rediscovered. Interviewee 11 said that we should not pay attention to the structure of the Living Lab –project since it should be an innovation project with very little limitations and he sees that it would disrupt the principles of the concept.

Interviewee 10 considers the lack of structure a negative aspect that should be correct for the project and the results to be more predictable. The predictability is especially important to a company since it does not see profitability in a project that cannot guarantee positive results that can be implemented in business. It is perceived that solving these four issues might influence the cost effectiveness and comparison of different Living Labs positively. (Interviewee 1)

The challenges with communication over projects and continuous participation need to be overcome do that the version 2.0 can be born.

The heterogeneous infrastructure, minimal communication of different Living Labs, problems in gaining continuous participation and scattered, insufficient documentation are all disturbing the development of Living Labs. (Interviewee 5; Interviewee 6; Interviewee 9) With a too heterogeneous infrastructure the comparison of Living Labs is difficult since the common denominators do not exist. The minimal communication between different Living

Labs creates overlapping projects which reduces the benefits of the information gained from the projects.

Starting a project is always challenging, in Living Labs especially, because of the lack of continuous participation. When participants agree to commit only to one project, the information and know-how they learn during the process disappears with them. It would be important to have experienced people in the project; this would be especially helpful at the beginning. In this way the start-up would go more smoothly since the "experts" already know what to do. It would not be non-profitable for the "experts" since they would gain more information from each project, cumulative know-how and experience. (Interviewee 6; Interviewee 9; Interviewee 10)

Elaborate documentation would help the understanding of current Living Lab projects and the conducting of future projects.

Insufficient documentation is one of the reasons for the missing guidelines. Many of the Living Lab participants will not bother with elaborate documentation because they do not think in to the future. For future Living Labs the results of previous projects do not mean much if it cannot be discovered how this result was achieved. The documentation would also help future projects avoid mistakes that were already made and would act as a written "expert" in starting and managing the project. (Interviewee5; Interviewee 6)

Finding users with and interest to the product or service in development increases the success rate.

Many of the interviewees had encountered the problem of finding end users during their own projects. Interviewee 6 and Interviewee 9 thought that establishing readymade user communities would help the future projects to find their end users easier. Interviewee 3 took the concept further and suggested setting up digital platforms where users could sign up for projects they consider interesting. To go even further with the proposition is to use the digital platform not just for recruiting end users but also as the main instrument for communicating and interacting with the user.

For the users to participate to a project the communication needs to be made as effortless as possible.

The digital platform for users might help lowering the threshold that seems to be very high among users. Commitment over several projects could also become more common since the users feel that they are not pressured to do anything and have easy access to the platform.

However, there should also be a reward system inside the platform, because the users most often need an incentive to give their innovations to the use of others. (Interviewee 3) The most positive scenario for giving incentives is that if users feel that their innovations are appreciated, and they even receive something out of it, they tell their friends to participate, which leads to more users.

Defining the situations, products and services where the Living Lab approach is the most profitable would increase the number of completed projects.

Interviewee 3 points out that the situations where a Living Lab approach is profitable should be listed. Companies should be aware that with a Living Lab project the timetable cannot be only a few months and too strict. Living Lab projects need time to provide the participants with sufficient information that deems the project a success. Living Lab –projects are seen most suitable for service developments, composing innovations and conducting wide researches, these project types really benefit from the user participation and have time to make the objective as good as it can be.

When considering the future of Living Labs from the interviewees' viewpoints it seems that there are still many factors that need further development before the theory will become more successful in practice:

- guidelines, methods, tools, structure
- for future success infrastructure, communication, continuous participation and documentation
- social media as a digital communication platform, commitment issues
- when to use a Living Lab theory

11 Conclusions of the study

11.1 Conclusions

The conclusions of this thesis are drawn using the written theory and answers from the interviews. They are divided according to the objectives given in section 1.2. The challenges and development suggestions are put to a different section from the rest of the thesis objectives.

- The concept behind Living Lab

The original concept of a Living Lab is to have end users participating in the production of products/services for themselves and other end users in a real-life environment with the help of other network participants. For a project to be called Living Lab it needs to have:

  - all the participants of the network(enabler, provider, utilizer and user)
  - a real-life environment (physical or virtual)
  - user-driven approach

These aspects were seen as important by the interviewees; in the theory section many specialists mentioned at least one of these aspects. When evaluating the theory and interview answers together, it seems that the best way to describe a Living Lab is through these three given factors. Although the experts do not seem to agree on one theory about Living Labs, during the writing of this thesis these three aspects have risen above others continuously, this is why it is concluded that a project needs to have these three attributes to be called a Living Lab

- Important factors benefitting the success of Living Labs

A proper foundation of the project helps the participants to understand the purpose and objectives of the Living Lab. These factors are important motivational aspects that take the project forward. Also, if the foundation is solid the extra time that it would take to learn the theory and the aspects of it can be used more profitably innovating and creating.

Sufficient interaction and discussion between all the network participants is necessary for creating and developing innovations. The diverse knowledge that presents itself in a network forms unique knowledge and innovations. The positive side of experts from different fields gathering together is that all of the specialists view the innovation from different angles. When different viewpoints need to be explained inside the network it makes all the participants question their own point of view and possibly adapt their differing views together into a better concept.

Flexibility in the project is another necessity when considering the possible success of Living Labs. The network participants need to be prepared to change the direction of the project if the current one does not function properly or if it seems that another approach might create better benefits. Also, the skill to know when to stop is important. Many companies, especially in Finland, seem to be unable to halt the project if it seems that it does not create

meaningful results. Continuing an unsuccessful project means more costs; frustration and usually forced failure in the end. This is why it is important for the companies to stop before they have yet used enormous amounts of funds for a project that would not create results anyway.

- The networks operations and participants

A Living Lab –network gathers together different specialists needed for the project to operate properly. If one of the participants is missing then the project cannot function the way it should in order to create best possible results. Network participants are:

  - enabler (public sector)
  - provider (Universities of Applied Sciences, research institutes, universities)
  - utilizer (companies)
  - user (end users)

In the previous section about important aspects of the Living Lab, it was shown that the continuous discussion and interaction is important for the operation of the network. The equality of the participants' innovations is necessary for the process. So long as all the opinions are seen as equal it does not disrupt the successful innovation, creation and development of innovations.

- The network participants' main tasks

The enabler (public sector) provides the project most of its funding. Without the enabler there would probably not be any Living Lab –projects due to the uncertainty of the project results that would stop a company from investing in it fully. The provider (Universities of Applied Sciences, research institutes and universities) gives the project most of its labour force, methods and tools for data gathering. Without the input of the provider the company would have to pay its employees to do the data gathering and analyzing which would again create more costs.

The utilizer (company) gives the project the innovation/service that is being developed. A part of the funding comes also from the company so that it can claim to results for itself. The user (end user) provides the know-how that the company would not be able to acquire in internal laboratory testing. The input of a user often reduces the possibility of the product/service failing when launched into the market.

11.2 Challenges

The biggest challenges of Living Labs are the lack of guidelines, structure and benchmarks, how to motivate people enough so that they participate continuously, who the patent goes to and how to manage company's confidentiality issues.

The lack of guidelines and structures hinders the beginning of the projects and also the whole duration of the project. Without guidelines people are operating half blind in a situation that would require an understanding of the different nuances that the project needs to be a success. A structure should help to keep the project and the innovations that happen in it surrounded by certain limits. If there are no limits to the innovation it can go to a completely different direction to what was supposed to. In addition to these, the missing benchmark cases also make it more difficult for the participants to picture what they are striving for.

The continuous participation of all the participants would be very important for the future of Living Labs. This would create cumulative know-how and experience that would improve the structure of projects since at least one of the participants knows what the purpose is. The cumulative know-how and experience could also help with the structuring of guidelines that would help other future projects. The motivation for this continuous participation is very difficult to determine, but perhaps an endogenous incentive at least in the case of company participants would increase the motivation. Motivating end users are unlikely to be done with the endogenous motivation but the use of exogenous motivation might help, although, this form of motivation might turn out to be too expensive long-term.

Another problem with end users is the fact that, if they come up with the product/service that is new and requires a patent, they might demand that the product/service should be patented in their name. There have been cases where end users have agreed to give up all rights to the innovation but they have still sued the company afterwards for not giving them anything in return. Also other participants might demand that the patent is their so in the beginning of the project clear rules need to be made about who benefits from which results of the Living Lab project.

At its purest a Living Lab should have openness from all participants of the network. The biggest issue here is the confidentiality problems that come from the companies. It is understandable that companies do not want to reveal their secrets, even to the network participants, but this hinders the Living Lab projects since they would require complete openness on all accounts.

11.3 Future requirements and aspects

For the Living Lab theory to thrive in the future there needs to be massive changes in the process of the project and also the determination of what the project is useful for. Proper guidelines and structuring is needed for the theory to operate properly. If possible, the next Living Lab project should be about creating the guidelines and structure for all the future international and national projects. The outcome of this project could be a book about the different aspects and needs of Living Labs. Participants in this project should include various specialists of the theory (i.e. Janne Orava, Mats Eriksson, Veli-Pekka Niitamo, Kimmo Rönkä, Jens Schumacher, Pieter Ballon).

The documentation of all existing and past projects could be used as benchmarks for future projects. Especially Arabianranta-Kumpula and other Living Labs done in similar situations could be good examples. All of the documentation should be put up to ENoLL so that its members could all profit from them. In the book it should also be determined which projects would benefit the most of the Living Lab approach. With product related projects the problems with confidentiality are often an issue, but in service related projects the testing can be done with prototypes which help to disregard the issues with confidentiality. Living Labs done for different living areas, such as the Arabianranta-Kumpula and Smart Cities by Professor William Mitchell, seem to have had most success so far.

The network participation should be reinforced and networks from different Living Lab projects should communicate together for fresh suggestions and various expert input. The continuous commitment is essential for the future of Living Labs because with the know-how that can be gathered from different projects with different infrastructure the comparison of various projects can be successful.

In conclusion, for Living Labs to keep on existing and gaining more momentum, among its possible participants and users, guidelines need to be drawn up, and projects need to be more structured without limiting the innovation process. Benchmark cases need to be documented and projects where the Living Lab –approach is most profitable need to be determined. With all these restrictions it is still important to remember that a Living Lab – process requires innovation to reach its full potential which is why over restricted structures and guidelines might change the purpose of Living Labs. Discovering a way to make a balance between structures and innovation is the real challenge of the future.

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FIGURES

TABLES

CHARTS

Attachments

Attachment 1 EnoLL registered countries that have ongoing Living Lab projects

Country	Number of Projects
Austria	3
Belgium	2
Brazil	4
Bulgaria	2
China	1
Czech Rep	1
Denmark	1
Finland	14
France	11
Germany	9
Greece	3
Hungary	3
Ireland	2
Italy	10
Malta	2
Mozambique	1
Netherlands	2
Norway	2
Portugal	8
Slovenia	3
South Africa	2
Spain	19
Sweden	7
Switzerland	3
Taiwan	2
UK	12

Attachment 2 EnoLL registered Living Lab projects in different countires